

FLEXIBLE COMMUNICATIONS COAX

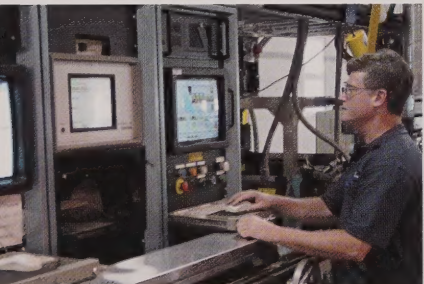
World Class Products for Wireless Applications

The History of TMS



Times Microwave Systems (TMS), a Smiths company, and a division of Smiths Group PLC was founded in 1948 as the Times Wire and Cable Company. TMS is an engineering oriented organization specializing in the design and manufacture of high performance flexible and semi-rigid coaxial cable, connectors, and cable assemblies for RF transmission from HF through Microwave frequencies. TMS is committed

to continuous improvement with respect to ISO-9001 Quality Standards and ISO-14001 Environmental Management Systems.



The expertise that provided cable solutions for the demanding requirements of airborne electronic warfare systems and led the way in the development of low smoke cables for shipboard applications is now yielding

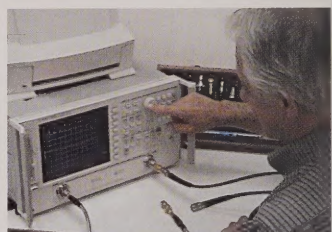
high performance cables to meet the needs of the wireless communications market. The innovative product line provides a better alternative to corrugated copper cables for antenna feeders and system interconnects. Compared to corrugated copper cables, LMR cables offer better flexibility, resistance to linking, comparable attenuation, and easier connector attachment at a lower cost.

The work performed at TMS in the 60's, 70's, and 80's forms the basis for today's high performance coaxial cables. TMS pioneered the development of closed cell low loss polyethylene foam dielectric and low loss taped PTFE dielectric coaxial cables. Through a thorough understanding of transmission line theory and manufacturing processes, TMS was the first to produce cables with reduced periodicity and impedance matched interfaces, resulting in the first transmission lines with low

VSWR over broadband frequency ranges up to 40 GHz. The development of connector design and manufacturing expertise allowed TMS to take full performance responsibility for the entire cable assembly, which was unprecedented at the time.

TMS has been instrumental in the development of military specifications, including MIL-C-17 for coaxial cables. Times is the leading source of MIL-C-17 qualified products, holding far more QPL's (Qualified Product Listings) than any other manufacturer in the world. Times also helped the US Navy write the MIL-T-81490 Transmission Line Specification, and is qualified to supply microwave transmission lines that meet MIL-T-81490 and MIL-C-87104 (US Air Force) requirements. These are the specifications that define harsh military airborne environments that Electronic Warfare transmission lines must perform in, year after year.

TMS applies its expertise to customer requirements through a staff of Field Application Engineers. Unlike other cable manufacturers with limited product lines, who try to fit customer applications to their existing products, the philosophy of TMS is to select or design the right product for the application. This results in an optimal and cost effective solution.



TMS is the leader in the design, qualification, manufacture, and on-time delivery of high performance cable and cable assembly products to the commercial wireless and military marketplace. In 2003, TMS was selected by Lockheed Martin Aeronautics to supply the Broadband Airborne Cable Assemblies on the F-35 Joint Strike Fighter (JSF). TMS was chosen to supply this solution since its high performance cable assemblies are able to handle high-speed data in extreme avionics environments including wide variations in temperature and pressure.



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LMR discussion



What is LMR cable?

Times LMR cables are high performance broadband, flexible, low loss 50 Ohm coaxial communication cables designed for use in wireless applications such as:

- 2-way land mobile
- IEEE, 802.11a & 802.11b
- Cellular
- Wireless local loop
- PCS
- LMDS
- Wireless Internet (WISP)
- MMDS
- Broadband wireless data
- CLEC
- Telemetry
- Paging

LMR is a complete system of cables, connectors, installation tools and accessories- everything you need to make your job simple and successful.

Where can LMR cables be used?

Times LMR cables can be used virtually anywhere high performance coaxial cables are used, including:

- Internal component and equipment wiring
- Inter/intra cabinet jumpers
- Base station and antenna jumpers
- Tower and pole feeder runs
- In-building runs, including riser runs and air-handling plenums
- Rooftop installations

What sizes of LMR cable are available?

A full range of LMR cables are available from LMR-100 (0.100") all the way up to LMR-1700-DB (1 1/4"). Because LMR cables are so flexible, it's possible to eliminate jumpers entirely in many feeder cable applications. The elimination of jumper cables provides reduced cost, better reliability and lower cost- or may even allow the use of a smaller size feeder cable, while achieving the same loss as for a larger corrugated feeder.

What are the advantages of LMR?

Times LMR cables have RF performance comparable to traditional corrugated copper cables, but unlike corrugated cables they are highly flexible, non-kinking, and offer unsurpassed ease and speed of connector installation. Compared to RG type braided cables, LMR cables offer far lower loss and better RF shielding. These features make LMR cables the best choice for *any* wireless application.

What makes LMR cable different than corrugated cables?

Design features of Times LMR cable include:

1) Polyethylene Foam Dielectric

- Closed cell
- Dry nitrogen gas injected- no moisture to degrade performance
- High velocity
- Low loss

2) High Performance Flexible Shielding System

- Multi-laminar aluminum composite tape bonded to the dielectric

- Provides >90dB isolation shielding (180dB cross talk)
- Bonded construction ensures 100% effective shielding
- Acts as a second moisture barrier
- Outer Braid of tinned copper:
 - Provides positive means for grounding and connector attachment

3) Polyethylene Outer Jacket

- Heavy duty UV, sunlight and weather resistant, 20 to 40 year life

How does LMR cable compare to RG type braided cable or 9913?

LMR cables have lower loss and far better shielding than comparably sized braided cables. Polyethylene jacket, closed cell foam poly dielectric and bonded tape conductor all contribute to the superior weather resistance of LMR cables compared to braided cables and 9913.

Is there only one type of LMR cable, or are there options?

Included in this catalog are the many different types of LMR cables which are available, so you can always be certain that there is an LMR cable just right for your particular application. Besides standard LMR cable, Times offers:

LMR-FR: Fire retardant cable for installation in building vertical risers or where fire retardancy is critical, both UL and CSA listed (CMR/MPR).

LMR-LLPL: Low loss plenum rated cables for use in virtually any in-building application, including air handling plenums and spaces where maximum fire retardancy and low smoke generation are required. LMR-LLPL cables are the most rugged and easiest to install plenum rated cables available, especially for difficult installs in older buildings. Cables are both UL and CSA listed (CMP/MPP).

LMR-DB: Watertight cables with an inert flooding compound injected in the braid to completely eliminate the possibility of any water migration- *with a 10 year warranty!* The DB feature is optional on sizes 600 and smaller, and standard on sizes 900 and larger.

LMR Ultraflex: Stranded center conductor and thermoplastic rubber jacket for maximum flexibility.

LMR-MA: Unbonded tape conductor for ease of removal for special applications.

LMR-PVC: Polyvinylchloride outer jacket for enhanced flexibility.

FBT: Similar to LMR-LLPL, but with a fluoropolymer (FEP) outer jacket for high temperature performance up to 150°C (302°F).

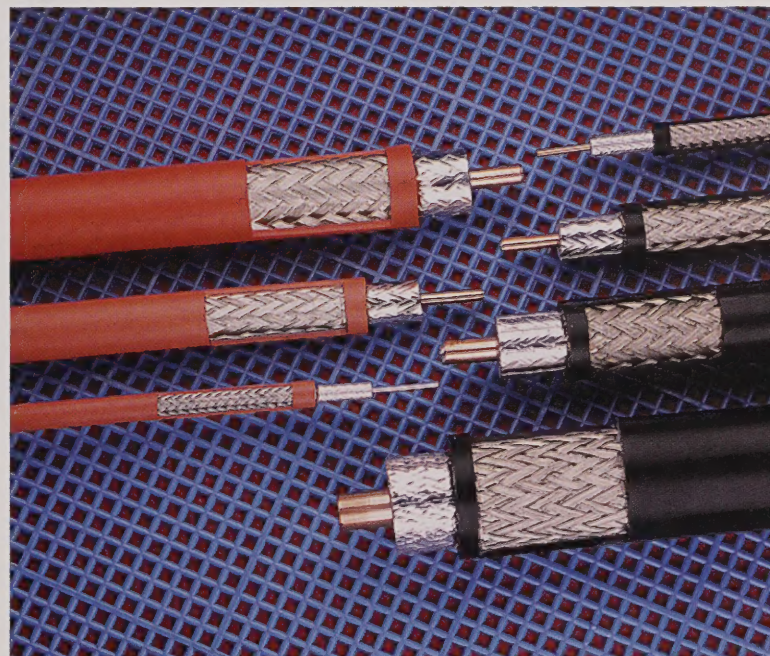
T-COM: The ultimate in low loss, high performance coax with a triple shielding system pioneered by Times to achieve enhanced shielding and low passive intermod (-155dB).

LMR-75: These are 75 Ohm versions of the standard LMR cable for unsurpassed performance in broadband video and specialized RF applications.

FlexRAD: 50 Ohm leaky feeder cable for RF coverage up to 2.5GHz. For use in buildings, mines, tunnels or any enclosed area. Flexible, non-kinking low cost design.

What about connectors and installation tools?

Times offers a complete line of connectors for all its cables. A wide variety of connector interfaces is offered for almost every application:



LMR discussion



- N
- BNC
- TNC
- UHF
- Reverse polarity
- MUHF
- 716DIN
- SMA
- QDS (quick disconnect)
- F
- LC
- HN
- QMA

Special connectors are available, and Times is always adding new ones. Times also offers a complete line of cable prep and connector installation tools, so you never will be frustrated by not having the right tools- Times is your one-stop source.

Do all Times connectors require soldering?

An extensive line of solder-pin type connectors is offered. However, Times has become the recognized industry leader in developing simplified connectors especially suited for field applications offering more non-solder type connectors than any other cable manufacturers. The Times well-known line of **EZ** non-solder connectors has become renowned in the industry. With center pin contacts made from silver or gold plated beryllium-copper, **EZ** connectors are the preferred choice for quick and reliable field installations.

How can I get cable and tower installation accessories that work with LMR cable?

Easy- Times furnishes a complete line of site installation hardware and accessories- everything you need to get you from the antenna to the equipment:

- **Ground kits:** Perfectly sized to each LMR cable, with never a chance of the ground strap being too tight (crushed cable), or too loose (poor grounding).
- **Hangers:** Snap-in, butterfly
- **Hoisting grips**
- **Weatherproofing kits:** Tape and cold shrink
- **Tie wraps**
- **Mounting hardware**
- **Entry ports and hardware**

Does anyone else make a cable like LMR?

Some have tried, but no one can match Times LMR when it comes to what's important to the customer. Some don't even offer anything but cable, while Times offers:

- The most complete line of cable, connectors (including **EZ**), tools and accessories
- The biggest range of sizes
- The most cable type options
- The most extensive distribution network
- Unsurpassed technical support
- The assurance that comes from knowing you are dealing with the industry leader, and
- *The only company with its phone number printed on every foot of cable we make.* You never have to guess who to call if you have a question or need help solving a problem, because everything is supplied by Times.

What about price?

In most cases Times LMR cables and connectors will save you money compared to corrugated cable. By combining the lower purchase cost with the ease and speed of installation, excellent savings are achieved. LMR cables also offer significant performance advantages compared to RG type cables at comparable prices.

How about jumpers and cable assemblies?

Times manufactures high quality LMR cable assemblies and Flextech jumpers- 100% factory tested before shipment for insertion loss and VSWR. Many of Times' LMR distributors also supply LMR cable assemblies and provide excellent service, especially for quick delivery requirements.

Where are LMR cables made?

Times LMR cables are manufactured in our ISO certified Wallingford, Connecticut plant, where we have been making high quality coaxial cable for over 50 years.

What about availability?

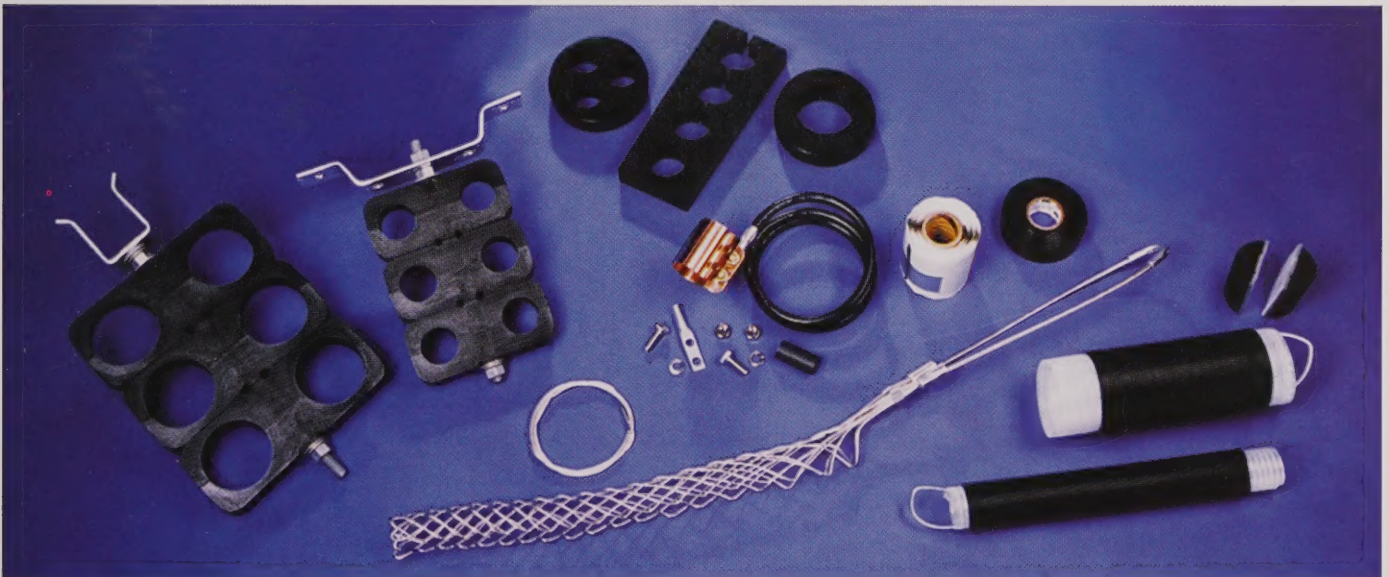
Times LMR cables, connectors and accessories are stocked by our vast network of national, regional and international distributors worldwide, so you are never far from a convenient source.

How can I get started using LMR cables?

Easy- just call our friendly Sales Department at either 1-800-TMS-COAX (1-800-867-2229) or 203-949-8400 and you can also visit our comprehensive web site at www.timesmicrowave.com for product and technical information or to request other Times literature.

I'm new at this and might need help with the connectors or accessories

Times has put together a CD-ROM with full "how-to" videos of many of the most popular EZ connectors as well as ground kits and other accessories. It also includes all our catalogs and a convenient Loss Calculator. We'd be glad to send you one to help you do the job right, so just call us or e-mail us and we'll get one right out to you. And if you ever need help on a job, just call us- our phone number is right on the cable.



TIMES MICROWAVE SYSTEMS

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LMR-100A

Flexible Low Loss Communications Coax

Ideal for...

- Drop-in Replacement for RG-316/RG-174 (uses standard connectors)
- Jumper Assemblies in Wireless Communications Systems
- Short Antenna Feeder runs
- Any application (e.g. WLL, GPS, LMR, Mobile Antennas) requiring an easily routed, low loss RF cable



• **LMR®-PVC** is designed for low loss general-purpose indoor/outdoor applications and is somewhat more flexible than the standard polyethylene jacketed LMR.

• **LMR®-PVC-W** is a white-jacketed version of LMR-PVC for marine and other indoor/outdoor applications where color compatibility is desired.

• **Flexibility** and bendability are hallmarks of the LMR-100A cable design. The flexible outer conductor enables the tightest bend radius available for any cable of similar size and performance.

• **Low Loss** is another hallmark feature of LMR-100A. Size for size LMR has the lowest loss of any flexible cable and comparable loss to semirigid hard-line cables.

• **RF Shielding** is 50 dB greater than typical single shielded coax (40 dB). The multi-ply bonded foil outer conductor is rated conservatively at > 90 dB (i.e. >180 dB between two adjacent cables).

• **Weatherability:** LMR-100A cables designed for outdoor exposure incorporate the best materials for UV resistance and have life expectancy in excess of 20 years.

• **Connectors:** A wide variety of connectors are available for LMR-100A cable, including all common interface types, reverse polarity, and a choice of solder or non-solder center pins. Most LMR connectors employ crimp outer attachment using standard hex crimp sizes.

• **Cable Assemblies:** All LMR-100A cable types are available as pre-terminated cable assemblies. Refer to the section on FlexTech for further details.

Construction Specifications

Description	Material	In.	(mm)
Inner Conductor	Solid BCCS	0.018	(0.46)
Dielectric	Solid PE	0.060	(1.52)
Outer Conductor	Aluminum Tape	0.065	(1.65)
Overall Braid	Tinned Copper	0.083	(2.11)
Jacket	PVC	0.110	(2.79)

Mechanical Specifications

Performance Property	Units	US	(metric)
Bend Radius: installation	in. (mm)	0.25	(6.4)
Bend Radius: repeated	in. (mm)	1	(25.4)
Bending Moment	ft-lb (N-m)	0.1	(0.14)
Weight	lb/ft (kg/m)	0.015	(0.02)
Tensile Strength	lb (kg)	15	(6.8)
Flat Plate Crush	lb/in. (kg/mm)	10	(0.18)

Environmental Specifications

Performance Property	°F	°C
Installation Temperature Range	-40/+185	-40/+85
Storage Temperature Range	-94/+185	-70/+185
Operating Temperature Range	-40/+185	-40/+85

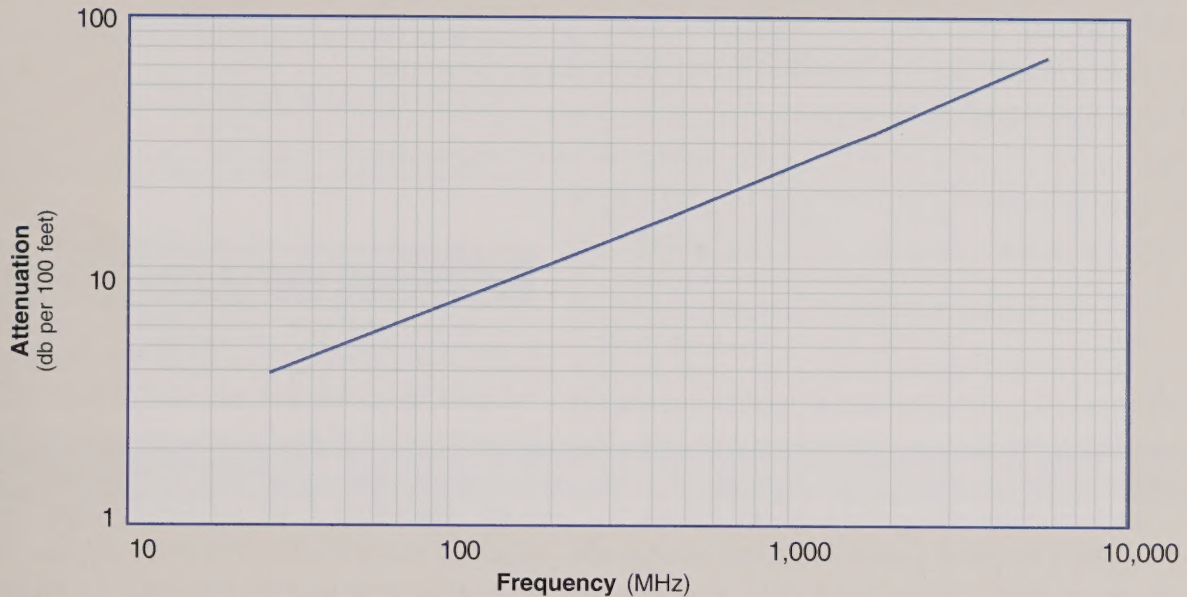
Electrical Specifications

Performance Property	Units	US	(metric)
Cutoff Frequency	GHz	90	
Velocity of Propagation	%	66	
Dielectric Constant	NA	2.30	
Time Delay	nS/ft (nS/m)	1.54	(5.05)
Impedance	ohms	50	
Capacitance	pF/ft (pF/m)	30.8	(101.1)
Inductance	uH/ft (uH/m)	0.077	(0.25)
Shielding Effectiveness	dB	>90	
DC Resistance			
Inner Conductor	ohms/1000ft (/km)	81.0	(266)
Outer Conductor	ohms/1000ft (/km)	9.5	(31.2)
Voltage Withstand	Volts DC	500	
Jacket Spark	Volts RMS	2000	
Peak Power	kW	0.6	

Part Description

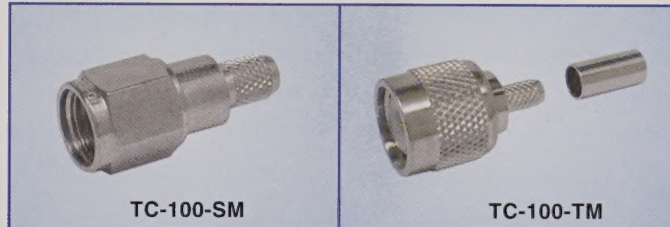
Part No.	Application	Jacket	Color	Stock Code
LMR-100A-PVC	Indoor/Outdoor	PVC	Black	54119
LMR-100A-PVC-W	Indoor/Outdoor	PVC	White	54200

Attenuation vs. Frequency (typical)



Frequency (MHz)	30	50	150	220	450	900	1500	1800	2000	2500	5800
Attenuation dB/100 ft	3.9	5.1	8.9	10.9	15.8	22.8	30.1	33.2	35.2	39.8	64.1
Attenuation dB/100 m	12.9	16.7	29.4	35.8	51.9	74.9	98.7	109.0	115.5	130.6	210.3
Avg. Power kW	0.23	0.18	0.10	0.08	0.06	0.4	0.03	0.03	0.03	0.02	0.01

Calculate Attenuation = $(0.709140) \cdot \sqrt{\text{FMHz}} + (0.001740) \cdot \text{FMHz}$ (interactive calculator available at <http://www.timesmicrowave/telecom>)
 Attenuation: VSWR=1.0; Ambient = +25°C (77°F) Power: VSWR=1.0; Ambient = +40°C; Inner Conductor = 100°C (212°F);
 Sea Level; dry air; atmospheric pressure; no solar loading



Connectors

Interface	Description	Part Number	Stock Code	VSWR** Freq. (GHz)	Coupling Nut	Inner Contact Attach	Outer Contact Attach	Finish* Body /Pin	Length in (mm)	Width in (mm)	Weight lb (g)
SMA male	Straight Plug	TC-100-SM	3190-1551	<1.25:1 (<3 GHz)	Hex	Solder	Crimp	SS/G	1.0 (25.4)	0.32 (8.1)	0.015 (6.8)
TNC male	Straight Plug	TC-100-TM	3190-1552	<1.25:1 (<3 GHz)	Knurl	Solder	Crimp	S/G	1.4 (35.6)	0.59 (15.0)	0.045 (20.4)

* Finish metals: N=Nickel, S=Silver, G=Gold, SS=Stainless Steel, A=Alballoy **VSWR spec based on 3 foot cable with a connector pair



Install Tools

Type	Part Number	Stock Code	Description
Crimp Tool	CT-240/200/195/100	3190-667	Crimp tool for LMR-100 connectors
Cutting Tool	CCT-01	3190-1544	Cable end flush cut tool
Replacement Blades	RB-01	3190-1609	Replacement blades for cutting tool



TIMES MICROWAVE SYSTEMS

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LMR-195

Flexible Low Loss Communications Coax

Ideal for...

- Jumper Assemblies in Wireless Communications Systems
- Short Antenna Feeder runs
- Any application (e.g. WLL, GPS, LMR, Mobil Antennas) requiring an easily routed, low loss RF cable
- Drop-in replacement for RG-58 and RG-142

• **LMR®** standard is a UV Resistant Polyethylene jacketed cable designed for 20-year service outdoor use. The bending and handling characteristics are significantly better than air-dielectric and corrugated hard-line cables.

• **LMR®-DB** is identical to standard LMR plus has the advantage of being watertight. The addition of waterproofing compound in and around the foil/braid insures continuous reliable service should the jacket be inadvertently damaged during installation or in the future.

• **LMR®-FR** is a non-halogen (non-toxic), low smoke, fire retardant cable designed for in-building runs that can be routed anywhere except air handling plenums. LMR-FR has a UL/NEC & CSA rating of 'CMR/MPR' and 'FT4' respectively.

• **LMR®-FR-PVC** is a general-purpose indoor cable and has a UL/NEC & CSA rating of 'CMR/MPR' and 'FT4' respectively. It is less expensive than LMR-FR, however it emits toxic fumes (HCL) and greater smoke density when burned.

• **LMR®-PVC** is designed for low loss general-purpose indoor/outdoor applications and is somewhat more flexible than the standard polyethylene jacketed LMR.

• **LMR®-PVC-W** is a white-jacketed version of LMR-PVC for marine and other indoor/outdoor applications where color compatibility is desired.

• **LMR®-MA** is a flexible cable designed specifically for mobile antenna applications. It has a PVC jacket and un-bonded aluminum tape to facilitate end stripping with automated equipment.

• **Flexibility** and bendability are hallmarks of the LMR-195 cable design. The flexible outer conductor enables the tightest bend radius available for any cable of similar size and performance.

• **Low Loss** is another hallmark feature of LMR-195. Size for size LMR has the lowest loss of any flexible cable and comparable loss to semirigid hard-line cables.

• **RF Shielding** is 50 dB greater than typical single shielded coax (40 dB). The multi-ply bonded foil outer conductor is rated conservatively at > 90 dB (i.e. >180 dB between two adjacent cables).

• **Weatherability:** LMR-195 cables designed for outdoor exposure incorporate the best materials for UV resistance and have life expectancy in excess of 20 years.

• **Connectors:** A wide variety of connectors are available for LMR-195 cable, including all common interface types, reverse polarity, and a choice of solder or non-solder center pins. Most LMR connectors employ crimp outer attachment using standard hex crimp sizes.

• **Cable Assemblies:** All LMR-195 cable types are available as pre-terminated cable assemblies. Refer to the section on FlexTech for further details.



Part Description

Part No.	Application	Jacket	Color	Stock Code
LMR-195	Outdoor	PE	Black	54110
LMR-195-DB	Outdoor/Watertight	PE	Black	54113
LMR-195-FR	Indoor-Riser CMR	FRPE	Black	54111
LMR-195-FR-PVC	Indoor-Riser CMR	FRPVC	Black	54215
LMR-195-PVC	Indoor/Outdoor	PVC	Black	54105
LMR-195-PVC-W	Indoor/Outdoor	PVC	White	54199
LMR-195-MA	Mobile Antenna	PVC	Black	54210

Construction Specifications

Description	Material	In.	(mm)
Inner Conductor	Solid BCCS	0.037	(0.94)
Dielectric	Foam PE	0.110	(2.79)
Outer Conductor	Aluminum Tape	0.116	(2.95)
Overall Braid	Tinned Copper	0.139	(3.53)
Jacket	(see table above)	0.195	(4.95)

Mechanical Specifications

Performance Property	Units	US	(metric)
Bend Radius: installation	in. (mm)	0.5	(12.7)
Bend Radius: repeated	in. (mm)	2	(50.8)
Bending Moment	ft-lb (N-m)	0.2	(0.27)
Weight	lb/ft (kg/m)	0.021	(0.03)
Tensile Strength	lb (kg)	40	(18.2)
Flat Plate Crush	lb/in. (kg/mm)	15	(0.27)

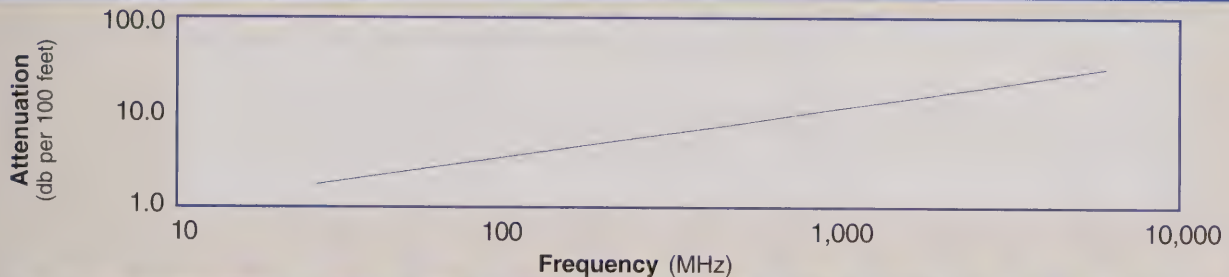
Environmental Specifications

Performance Property	°F	°C
Installation Temperature Range	-40/+185	-40/+85
Storage Temperature Range	-94/+185	-70/+185
Operating Temperature Range	-40/+185	-40/+85

Electrical Specifications

Performance Property	Units	US	(metric)
Cutoff Frequency	GHz	41	
Velocity of Propagation	%	80	
Dielectric Constant	NA	1.56	
Time Delay	nS/ft (nS/m)	1.27	(4.17)
Impedance	ohms	50	
Capacitance	pF/ft (pF/m)	25.4	(83.3)
Inductance	uH/ft (uH/m)	0.064	(0.21)
Shielding Effectiveness	dB	>90	
DC Resistance			
Inner Conductor	ohms/1000ft (/km)	7.6	(24.9)
Outer Conductor	ohms/1000ft (/km)	4.9	(16.1)
Voltage Withstand	Volts DC	1000	
Jacket Spark	Volts RMS	3000	
Peak Power	kW	2.5	

Attenuation vs. Frequency (typical)



Frequency (MHz)	30	50	150	220	450	900	1500	1800	2000	2500	5800
Attenuation dB/100 ft	2.0	2.5	4.4	5.4	7.8	11.1	14.5	16.0	16.9	19.0	29.9
Attenuation dB/100 m	6.5	8.4	14.6	17.7	25.5	36.5	47.7	52.5	55.4	62.4	98.1
Avg. Power kW	0.89	0.68	0.39	0.32	0.22	0.16	0.12	0.11	0.10	0.09	0.06

Calculate Attenuation = $(0.356859) \cdot \sqrt{\text{FMHz}} + (0.000470) \cdot \text{FMHz}$ (interactive calculator available at <http://www.timesmicrowave/telecom>)
 Attenuation: VSWR=1.0; Ambient = +25°C (77°F) Power: VSWR=1.0; Ambient = +40°C; Inner Conductor = 100°C (212°F);
 Sea Level; dry air; atmospheric pressure; no solar loading



Connectors

Interface	Description	Part Number	Stock Code	VSWR**	Coupling	Inner Contact	Outer Contact	Finish*	Length in (mm)	Width in (mm)	Weight lb (g)
N male	Straight Plug	TC-195-NM	3190-224	<1.25:1 (25)	Knurl	Solder	Crimp	SG	15 (38.1)	0.75 (19.1)	0.073 (33.1)
SMA male	Straight Plug	TC-195-SM	3190-1551	<1.25:1 (25)	Hex	Solder	Crimp	SS/G	1.0 (25.4)	0.32 (8.1)	0.015 (6.8)
TNC male	Straight Plug	TC-195-TM	3190-1552	<1.25:1 (25)	Knurl	Solder	Crimp	SG	14 (35.6)	0.59 (15.0)	0.045 (20.4)

* Finish metals: N=Nickel, S=Silver, G=Gold, SS=Stainless Steel, A=Alloy **VSWR spec based on 3 foot cable with a connector pair

Install Tools

Type	Part Number	Stock Code	Description
Crimp Tool	CT-240/200/195/100	3190-667	Crimp tool for LMR-195 connectors
Cutting Tool	CCT-01	3190-1544	Cable end flush cut tool
Replacement Blades	RB-01	3190-1609	Replacement blades for cutting tool



TIMES MICROWAVE SYSTEMS

A Smiths Group plc company

LMR-200

Flexible Low Loss Communications Coax

Ideal for...

- Jumper Assemblies in Wireless Communications Systems
- Short Antenna Feeder runs
- Any application (e.g. WLL, GPS, LMR, Mobile Antennas) requiring an easily routed, low loss RF cable



• **LMR® standard** is a UV Resistant Polyethylene jacketed cable designed for 20-year service outdoor use. The bending and handling characteristics are significantly better than air-dielectric and corrugated hard-line cables.

• **LMR® - DB** is identical to standard LMR plus has the advantage of being watertight. The addition of waterproofing compound in and around the foil/braid insures continuous reliable service should the jacket be inadvertently damaged during installation or in the future.

• **LMR® - FR** is a non-halogen (non-toxic), low smoke, fire retardant cable designed for in-building runs that can be routed anywhere except air handling plenums. LMR-FR has a UL/NEC & CSA rating of 'CMR/MPR' and 'FT4' respectively.

• **LMR® - FR-PVC** is a general-purpose indoor cable and has a UL/NEC & CSA rating of 'CMR/MPR' and 'FT4' respectively. It is less expensive than LMR-FR, however it emits toxic fumes (HCL) and greater smoke density when burned.

• **LMR® - PVC** is designed for low loss general-purpose indoor/outdoor applications and is somewhat more flexible than the standard polyethylene jacketed LMR.

• **LMR® - PVC-W** is a white-jacketed version of LMR-PVC for marine and other indoor/outdoor applications where color compatibility is desired.

• **LMR® - MA** is a flexible cable designed specifically for mobile antenna applications. It has a PVC jacket and un-bonded aluminum tape to facilitate end stripping with automated equipment.

• **Flexibility** and bendability are hallmarks of the LMR-200 cable design. The flexible outer conductor enables the tightest bend radius available for any cable of similar size and performance.

• **Low Loss** is another hallmark feature of LMR-200. Size for size LMR has the lowest loss of any flexible cable and comparable loss to semirigid hard-line cables.

• **RF Shielding** is 50 dB greater than typical single shielded coax (40 dB). The multi-ply bonded foil outer conductor is rated conservatively at > 90 dB (i.e. >180 dB between two adjacent cables).

• **Weatherability:** LMR-200 cables designed for outdoor exposure incorporate the best materials for UV resistance and have life expectancy in excess of 20 years.

• **Connectors:** A wide variety of connectors are available for LMR-200 cable, including all common interface types, reverse polarity, and a choice of solder or non-solder center pins. Most LMR connectors employ crimp outer attachment using standard hex crimp sizes.

• **Cable Assemblies:** All LMR-200 cable types are available as pre-terminated cable assemblies. Refer to the section on FlexTech for further details.

Part Description				Stock
Part No.	Application	Jacket	Color	Code
LMR-200	Outdoor	PE	Black	54022
LMR-200-DB	Outdoor/Watertight	PE	Black	54089
LMR-200-FR	Indoor-Riser CMR	FRPE	Black	54028
LMR-200-FR-PVC	Indoor-Riser CMR	FRPVC	Black	54125
LMR-200-PVC	Indoor/Outdoor	PVC	Black	54216
LMR-200-PVC-W	Indoor/Outdoor	PVC	White	54201
LMR-200-MA	Mobile Antennas	PVC	Black	54045

Construction Specifications			
Description	Material	In.	(mm)
Inner Conductor	Solid BC	0.044	(1.12)
Dielectric	Foam PE	0.116	(2.95)
Outer Conductor	Aluminum Tape	0.121	(3.07)
Overall Braid	Tinned Copper	0.144	(3.66)
Jacket	(see table above)	0.195	(4.95)

Mechanical Specifications

Performance Property	Units	US	(metric)
Bend Radius: installation	in. (mm)	0.5	(12.7)
Bend Radius: repeated	in. (mm)	2	(50.8)
Bending Moment	ft-lb (N-m)	0.2	(0.27)
Weight	lb/ft (kg/m)	0.022	(0.03)
Tensile Strength	lb (kg)	40	(18.2)
Flat Plate Crush	lb/in. (kg/mm)	15	(0.27)

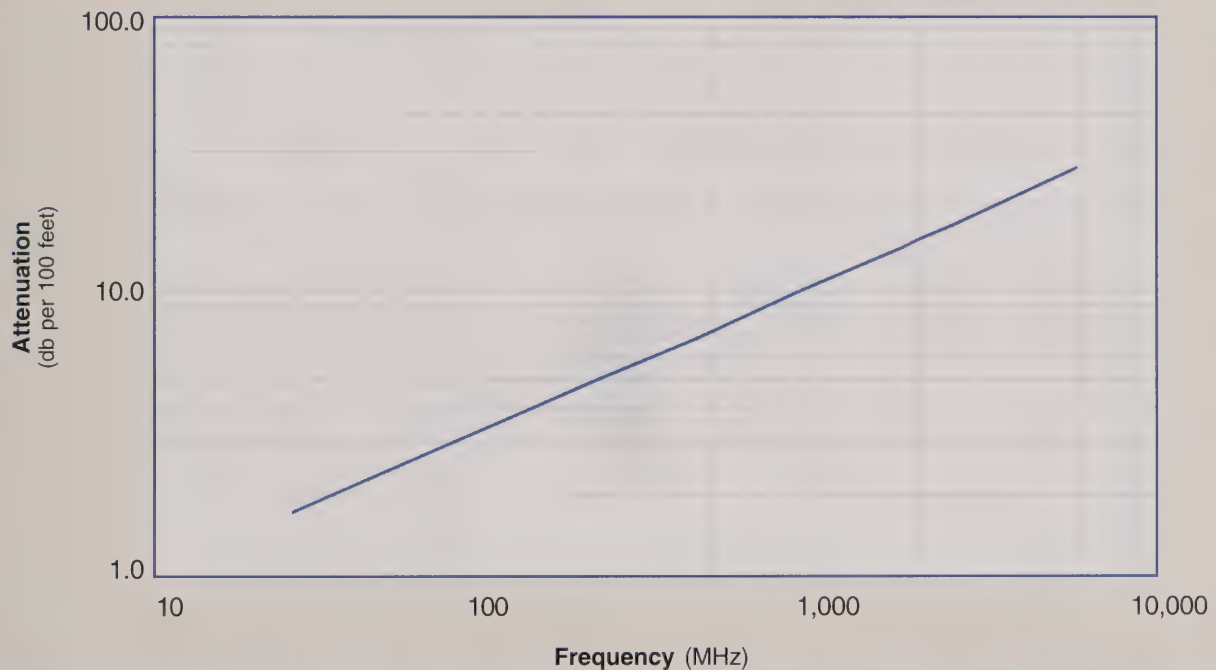
Environmental Specifications

Performance Property	°F	°C
Installation Temperature Range	-40/+185	-40/+85
Storage Temperature Range	-94/+185	-70/+185
Operating Temperature Range	-40/+185	-40/+85

Electrical Specifications

Performance Property	Units	US	(metric)
Cutoff Frequency	GHz	39	
Velocity of Propagation	%	83	
Dielectric Constant	NA	1.45	
Time Delay	nS/ft (nS/m)	1.22	(4.02)
Impedance	ohms	50	
Capacitance	pF/ft (pF/m)	24.5	(80.3)
Inductance	uH/ft (uH/m)	0.061	(0.20)
Shielding Effectiveness	dB	>90	
DC Resistance			
Inner Conductor	ohms/1000ft (/km)	5.4	(17.6)
Outer Conductor	ohms/1000ft (/km)	4.9	(16.1)
Voltage Withstand	Volts DC	1000	
Jacket Spark	Volts RMS	3000	
Peak Power	kW	2.5	

Attenuation vs. Frequency (typical)



Frequency (MHz)	30	50	150	220	450	900	1500	1800	2000	2500	5800
Attenuation dB/100 ft	1.8	2.3	4.0	4.8	7.0	9.9	12.9	14.2	15.0	16.9	26.4
Attenuation dB/100 m	5.8	7.5	13.1	15.9	22.8	32.6	42.4	46.6	49.3	55.4	86.5
Avg. Power kW	1.02	0.79	0.45	0.37	0.26	0.18	0.14	0.13	0.12	0.11	0.07

Calculate Attenuation =

$(0.320900) \cdot \sqrt{\text{FMHz}} + (0.000330) \cdot \text{FMHz}$ (interactive calculator available at <http://www.timesmicrowave/telecom>)

Attenuation:

VSWR=1.0; Ambient = +25°C (77°F)

Power:

VSWR=1.0; Ambient = +40°C; Inner Conductor = 100°C (212°F); Sea Level; dry air; atmospheric pressure; no solar loading

TIMES MICROWAVE SYSTEMS

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LMR-200

Flexible Low Loss Communications Coax



Connectors

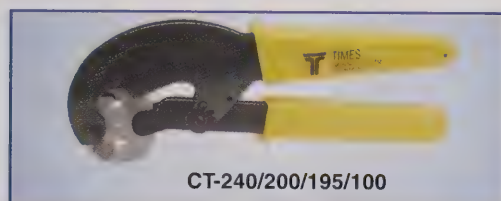
Interface	Description	Part Number	Stock Code	VSWR** Freq. (GHz)	Coupling Nut	Inner Contact Attach	Outer Contact Attach	Finish* Body /Pin	Length in (mm)	Width in (mm)	Weight lb (g)
BNC male	Straight Plug	TC-200-BM	3190-225	<1.25:1 (2.5)	Knurl	Solder	Crimp	S/G	1.7 (43.2)	0.56 (14.2)	0.045 (20.4)
Mini-UHF	Straight Plug	TC-200-MUHF	3190-444	<1.25:1 (2.5)	Knurl	Solder	Crimp	NG	1.1 (27.9)	0.45 (11.4)	0.015 (6.8)
N male	Straight Plug	EZ-200-NM	3190-1475	<1.25:1 (8)	Knurl	Spring Fit	Crimp	S/G	1.5 (38.1)	0.75 (19.1)	0.073 (33.1)
N male	Straight Plug	TC-200-NM	3190-224	<1.25:1 (2.5)	Knurl	Solder	Crimp	S/G	1.5 (38.1)	0.75 (19.1)	0.073 (33.1)
N male	Reverse Polarity	TC-200-NM-RP	3190-959	<1.25:1 (2.5)	Knurl	Solder	Crimp	NG	1.5 (38.1)	0.75 (19.1)	0.073 (33.1)
SMA male	Straight Plug	TC-200-SM	3190-612	<1.25:1 (8)	Hex	Solder	Crimp	SS/G	1.0 (25.4)	0.32 (8.1)	0.015 (6.8)
SMA male	Reverse Polarity	TC-200-SM-RP	3190-327	<1.25:1 (2.5)	Hex	Solder	Crimp	SS/G	1.0 (25.4)	0.32 (8.1)	0.015 (6.8)
TNC male	Straight Plug	EZ-200-TM	3190-1266	<1.25:1 (2.5)	Knurl	Spring Fit	Crimp	S/G	1.4 (35.6)	0.59 (15.0)	0.045 (20.4)
TNC male	Straight Plug	TC-200-TMC	3190-240	<1.25:1 (2.5)	Knurl	Solder	Clamp	S/G	1.7 (43.2)	0.59 (15.0)	0.045 (20.4)
TNC male	Reverse Polarity	EZ-200-TM-RP	3190-792	<1.25:1 (2.5)	Knurl	Spring Fit	Crimp	A/G	1.4 (35.6)	0.32 (8.1)	0.045 (20.4)
TNC female	Straight Jack	TC-200-TF	3190-263	<1.25:1 (2.5)	NA	Solder	Crimp	NG	1.3 (33.0)	0.57 (14.5)	0.033 (15.0)
TNC female	Reverse Polarity	EZ-200-TF-RP	3190-793	<1.25:1 (2.5)	NA	Spring Fit	Crimp	A/G	1.3 (33.0)	0.57 (14.5)	0.033 (15.0)

* Finish metals: N=Nickel, S=Silver, G=Gold, SS=Stainless Steel, A=Alballoy **VSWR spec based on 3 foot cable with a connector pair



Hardware Accessories

Type	Part Number	Stock Code	Description
Ground Kit	GK-S200T	GK-S200T	Standard Ground Kit (each)



Install Tools

Type	Part Number	Stock Code	Description
Crimp Tool	CT-240/200/195/100	3190-667	Crimp tool for LMR 200 connectors
Cutting Tool	CCT-01	3190-1544	Cable end flush cut tool
Replacement Blades	RB-01	3190-1609	Replacement blades for cutting tool

TIMES MICROWAVE SYSTEMS

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LMR-240

Flexible Low Loss Communications Coax

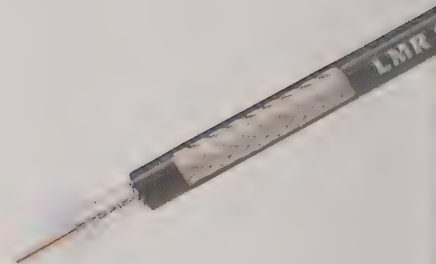
Ideal for...

- Jumper Assemblies in Wireless Communications Systems
- Short Antenna Feeder runs (e.g. WLL, GPS, LMR, Mobile Antennas)
- Any application requiring an easily routed, low loss RF cable

- **LMR® standard** is a UV Resistant Polyethylene jacketed cable designed for 20-year service outdoor use. The bending and handling characteristics are significantly better than air-dielectric and corrugated hard-line cables.
- **LMR® - DB** is identical to standard LMR plus has the advantage of being watertight. The addition of waterproofing compound in and around the foil/braid insures continuous reliable service should the jacket be inadvertently damaged during installation or in the future.
- **LMR® - FR** is a non-halogen (non-toxic), low smoke, fire retardant cable designed for in-building runs that can be routed anywhere except air handling plenums. LMR-FR has a UL/NEC & CSA rating of 'CMR/MPR' and 'FT4' respectively.
- **LMR® - FR-PVC** is a general-purpose indoor cable and has a UL/NEC & CSA rating of 'CMR/MPR' and 'FT4' respectively. It is less expensive than LMR-FR, however it emits toxic fumes (HCL) and greater smoke density when burned.
- **LMR® - PVC** is designed for low loss general-purpose indoor/outdoor applications and is somewhat more flexible than the standard polyethylene jacketed LMR.
- **LMR® - PVC-W** is a white-jacketed version of LMR-PVC for marine and other indoor/outdoor applications where color compatibility is desired.
- **LMR® - MA** is a flexible cable designed specifically for mobile antenna applications. It has a PVC jacket and un-bonded aluminum tape to facilitate end stripping with automated equipment.

- **Flexibility** and bendability are hallmarks of the LMR-240 cable design. The flexible outer conductor enables the tightest bend radius available for any cable of similar size and performance.

- **Low Loss** is another hallmark feature of LMR-240. Size for size LMR has the lowest loss of any flexible cable and comparable loss to semirigid hard-line cables.
- **RF Shielding** is 50 dB greater than typical single shielded coax (40 dB). The multi-ply bonded foil outer conductor is rated conservatively at > 90 dB (i.e. >180 dB between two adjacent cables).
- **Weatherability:** LMR-240 cables designed for outdoor exposure incorporate the best materials for UV resistance and have life expectancy in excess of 20 years.
- **Connectors:** A wide variety of connectors are available for LMR-240 cable, including all common interface types, reverse polarity, and a choice of solder or non-solder center pins. Most LMR connectors employ crimp outer attachment using standard hex crimp sizes.
- **Cable Assemblies:** All LMR-240 cable types are available as pre-terminated cable assemblies. Refer to the section on FlexTech for further details.



Part Description					Stock Code
Part Number	Application	Jacket	Color		
LMR-240	Outdoor	PE	Black		54021
LMR-240-DB	Outdoor/Watertight	PE	Black		54090
LMR-240-FR	Indoor -Riser CMR	FRPE	Black		54029
LMR-240-FR-PVC	Indoor -Riser CMR	FRPVC	Black		54214
LMR-240-PVC	Indoor/Outdoor	PVC	Black		54140
LMR-240-PVC-W	Indoor/Outdoor	PVC	White		54202
LMR-240-MA	Indoor & Mobile Antenna	PVC	Black		54046

Construction Specifications				
Description	Material	In.	(mm)	
Inner Conductor	Solid BC	0.056	(1.42)	
Dielectric	Foam PE	0.150	(3.81)	
Outer Conductor	Aluminum Tape	0.155	(3.94)	
Overall Braid	Tinned Copper	0.178	(4.52)	
Jacket	(see table above)	0.240	(6.10)	

Mechanical Specifications

Performance Property	Units	US	(metric)
Bend Radius: installation	in. (mm)	0.75	(19.1)
Bend Radius: repeated	in. (mm)	2.5	(63.5)
Bending Moment	ft-lb (N-m)	0.25	(0.34)
Weight	lb/ft (kg/m)	0.034	(0.05)
Tensile Strength	lb (kg)	80	(36.3)
Flat Plate Crush	lb/in. (kg/mm)	20	(0.36)

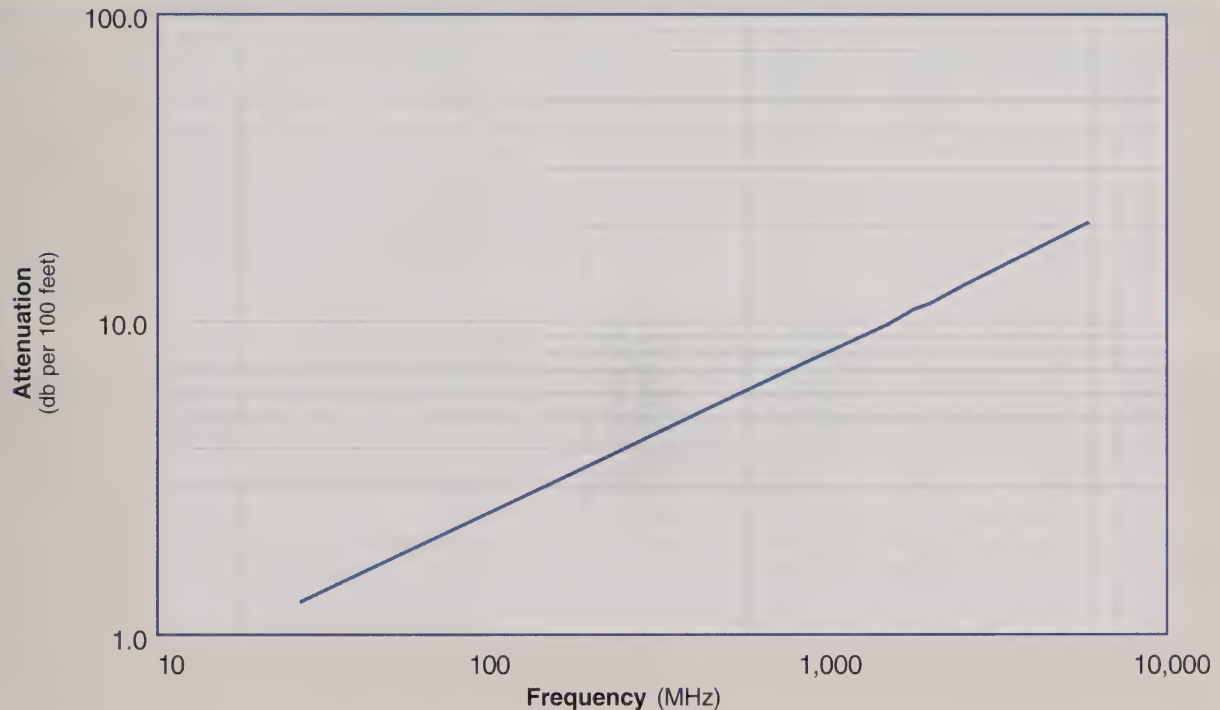
Environmental Specifications

Performance Property	°F	°C
Installation Temperature Range	-40/+185	-40/+85
Storage Temperature Range	-94/+185	-70/+185
Operating Temperature Range	-40/+185	-40/+85

Electrical Specifications

Performance Property	Units	US	(metric)
Cutoff Frequency	GHz	31	
Velocity of Propagation	%	84	
Dielectric Constant	NA	1.42	
Time Delay	nS/ft (nS/m)	1.21	(3.97)
Impedance	ohms	50	
Capacitance	pF/ft (pF/m)	24.2	(79.4)
Inductance	uH/ft (uH/m)	0.060	(0.20)
Shielding Effectiveness	dB	>90	
DC Resistance			
Inner Conductor	ohms/1000ft (/km)	3.2	(10.5)
Outer Conductor	ohms/1000ft (/km)	3.89	(12.8)
Voltage Withstand	Volts DC	1500	
Jacket Spark	Volts RMS	5000	
Peak Power	kW	5.6	

Attenuation vs. Frequency (typical)



Frequency (MHz)	30	50	150	220	450	900	1500	1800	2000	2500	5800
Attenuation dB/100 ft	1.3	1.7	3.0	3.7	5.3	7.6	9.9	10.9	11.5	12.9	20.4
Attenuation dB/100 m	4.4	5.7	9.9	12.0	17.3	24.8	32.4	35.6	37.7	42.4	66.8
Avg. Power kW	1.49	1.15	0.66	0.54	0.38	0.26	0.20	0.18	0.17	0.15	0.10

Calculate Attenuation =

$(0.242080) \cdot \sqrt{\text{FMHz}} + (0.000330) \cdot \text{FMHz}$ (interactive calculator available at <http://www.timesmicrowave/telecom>)

Attenuation:

VSWR=1.0; Ambient = +25°C (77°F)

Power: VSWR=1.0; Ambient = +40°C; Inner Conductor = 100°C (212°F); Sea Level; dry air; atmospheric pressure; no solar loading

TIMES MICROWAVE SYSTEMS

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LMR-240

Flexible Low Loss Communications Coax

			
EZ-240-NM	TC-240-NMH	TC-240-NMC	TC-240-NM-RA-(A)
			
TC-240-NF-BHF (A)	TC-240-BMC	TC-240-BM (A)	EZ-240-TM
			
TC-240-TM	TC-240-TM-RA	EZ-240-TM-RP	TC-240-SM
			
TC-240-SM-RA	TC-240-SM-RP	TC-240-SF-BH	TC-240-MUHF

Connectors

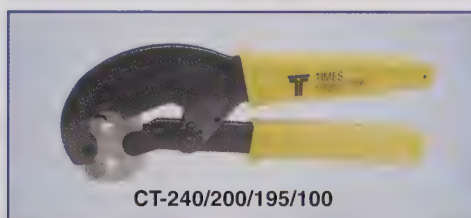
Interface	Description	Part Number	Stock Code	VSWR** Freq. (GHz)	Coupling Nut	Inner Contact Attach	Outer Contact Attach	Finish* Body /Pin	Length in (mm)	Width in (mm)	Weight lb (g)
N Male	Straight Plug	EZ-240-NM	3190-1127	<1.25:1 (2.5)	Knurl	Spring Finger	Crimp	NG	1.5 (38.1)	0.78 (19.8)	0.086 (39.0)
N Male	Straight Plug	TC-240-NMH	3190-382	<1.25:1 (2.5)	Hex	Solder	Crimp	NS	1.5 (38)	0.75 (19.1)	0.086 (39.0)
N Male	Straight Plug	TC-240-NMC	3190-244	<1.25:1 (2.5)	Knurl	Solder	Clamp	S/G	1.5 (38)	0.75 (19.1)	0.082 (37.2)
N Male	Right Angle	TC-240-NM-RA(A)	3190-868	<1.35:1 (2.5)	Hex	Solder	Crimp	A/G	1.3 (33)	1.14 (29.1)	0.105 (47.6)
N Female	Bulkhead Jack	TC-240-NF-BH	3190-419	<1.25:1 (2.5)	NA	Solder	Crimp	A/G	1.7 (44)	0.88 (22.2)	0.115 (52.2)
N Female	Bulkhead Jack	TC-240-NF-BHF(A)	3190-866	<1.25:1 (2.5)	NA	Solder	Crimp	A/G	1.7 (44)	0.88 (22.2)	0.115 (52.2)
BNC Male	Straight Plug	TC-240-BMC	3190-242	<1.25:1 (2.5)	Knurl	Solder	Clamp	S/G	1.7 (43)	0.56 (14.2)	0.040 (18.1)
BNC Male	Straight Plug	TC-240-BM(A)	3190-867	<1.25:1 (2.5)	Knurl	Solder	Crimp	A/G	1.7 (43)	0.56 (14.2)	0.043 (19.5)
TNC Male	Straight Plug	EZ-240-TM	3190-1128	<1.25:1 (2.5)	Knurl	Spring Finger	Crimp	NG	1.4 (34.3)	0.59 (15.0)	0.043 (19.5)
TNC Male	Straight Plug	TC-240-TM	3190-275	<1.25:1 (2.5)	Knurl	Solder	Crimp	NS	1.7 (43)	0.59 (15.0)	0.043 (19.5)
TNC Male	Right Angle	TC-240-TM-RA	3190-604	<1.35:1 (2.5)	Knurl	Solder	Crimp	NG	1.3 (33)	0.57 (14.5)	0.055 (24.9)
TNC Male	Reverse Polarity	EZ-240-TM-RP	3190-970	<1.25:1 (2.5)	Knurl	Spring Finger	Crimp	A/G	1.4 (36)	0.59 (15.0)	0.043 (19.5)
SMA Male	Straight Plug	TC-240-SM	3190-380	<1.25:1 (10)	Hex	Solder	Crimp	SS/G	1.0 (25)	0.32 (8.1)	0.016 (7.3)
SMA Male	Right Angle	TC-240-SM-RA	3190-381	<1.35:1 (6)	Hex	Solder	Crimp	SS/G	0.8 (20)	0.65 (16.5)	0.019 (8.6)
SMA Male	Reverse Polarity	TC-240-SM-RP	3190-326	<1.25:1 (2.5)	Hex	Solder	Crimp	SS/G	1.0 (25)	0.32 (8.1)	0.016 (7.3)
SMA Female	Bulkhead Jack	TC-240-SF-BH	3190-824	<1.25:1 (2.5)	NA	Solder	Crimp	SS/G	1.1 (29)	0.31 (7.9)	0.019 (8.6)
Mini-UHF	Straight Plug	TC-240-MUHF	3190-445	<1.25:1 (2.5)	Knurl	Solder	Crimp	NG	1.1 (28)	0.45 (11.4)	0.014 (6.4)

* Finish metals: N=Nickel, S=Silver, G=Gold, SS=Stainless Steel, A=Alballoy **VSWR spec based on 3 foot cable with a connector pair



Hardware Accessories

Type	Part Number	Stock Code	Description
Ground Kit	GK-S240T	GK-S240T	Standard Ground Kit (each)



Install Tools

Type	Part Number	Stock Code	Description
Crimp Tool	CT-240/200/195/100	3190-667	Crimp tool for LMR 240 connectors
Cutting Tool	CCT-01	3190-1544	Cable end flush cut tool
Replacement Blades	RB-01	3190-1609	Replacement blades for cutting tool

TIMES MICROWAVE SYSTEMS

A Smiths Group plc company

LMR-300

Flexible Low Loss Communications Coax

Ideal for...

- Jumper Assemblies in Wireless Communications Systems
- Short Antenna Feeder runs
- Any application (e.g. WLL, GPS, LMR) requiring an easily routed, low loss RF cable

• **LMR® standard** is a UV Resistant Polyethylene jacketed cable designed for 20-year service outdoor use. The bending and handling characteristics are significantly better than air-dielectric and corrugated hard-line cables.

• **LMR® - DB** is identical to standard LMR plus has the advantage of being watertight. The addition of waterproofing compound in and around the foil/braid insures continuous reliable service should the jacket be inadvertently damaged during installation or in the future.

• **LMR® - FR** is a non-halogen (non-toxic), low smoke, fire retardant cable designed for in-building runs that can be routed anywhere except air handling plenums. LMR-FR has a UL/NEC & CSA rating of 'CMR/MPR' and 'FT4' respectively.

• **LMR® - FR-PVC** is a general-purpose indoor cable and has a UL/NEC & CSA rating of 'CMR/MPR' and 'FT4' respectively. It is less expensive than LMR-FR, however it emits toxic fumes (HCL) and greater smoke density when burned.

• **LMR® - PVC** is designed for low loss general-purpose indoor/outdoor applications and is somewhat more flexible than the standard polyethylene jacketed LMR.

• **LMR® - PVC-W** is a white-jacketed version of LMR-PVC for marine and other indoor/outdoor applications where color compatibility is desired.

• **Flexibility** and bendability are hallmarks of the LMR-300 cable design. The flexible outer conductor enables the tightest bend radius available for any cable of similar size and performance.

• **Low Loss** is another hallmark feature of LMR-300. Size for size LMR has the lowest loss of any flexible cable and comparable loss to semirigid hard-line cables.

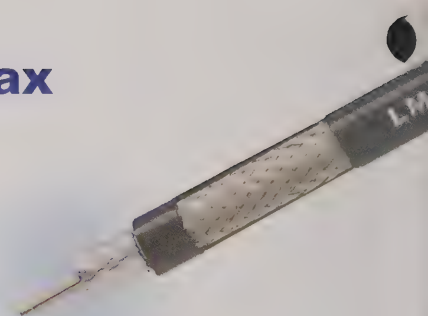
• **RF Shielding** is 50 dB greater than typical single shielded coax (40 dB). The multi-ply bonded foil outer conductor is rated conservatively at > 90 dB (i.e. >180 dB between two adjacent cables).

• **Weatherability:** LMR-300 cables designed for outdoor exposure incorporate the best materials for UV resistance and have life expectancy in excess of 20 years.

• **Connectors:** A wide variety of connectors are available for LMR-300 cable, including all common interface types, reverse polarity, and a choice of solder or non-solder center

pins. Most LMR connectors employ crimp outer attachment using standard hex crimp sizes.

• **Cable Assemblies:** All LMR-300 cable types are available as pre-terminated cable assemblies. Refer to the section on FlexTech for further details.



Part Description				Stock Code
Part Number	Application	Jacket Color		
LMR-300	Outdoor	PE	Black	54086
LMR-300-DB	Outdoor/Watertight	PE	Black	54114
LMR-300-FR	Indoor -Riser CMR	FRPE	Black	54087
LMR-300-FR-PVC	Indoor -Riser CMR	FRPVC	Black	54108
LMR-300-PVC	Indoor/Outdoor	PVC	Black	54217
LMR-300-PVC-W	Indoor/Outdoor	PVC	White	54203

Construction Specifications			
Description	Material	In.	(mm)
Inner Conductor	Solid BC	0.070	(1.78)
Dielectric	Foam PE	0.190	(4.83)
Outer Conductor	Aluminum Tape	0.196	(4.98)
Overall Braid	Tinned Copper	0.225	(5.72)
Jacket	(see table above)	0.300	(7.62)

Environmental Specifications			
Performance Property	°F	°C	
Installation Temperature Range	-40/+185	-40/+85	
Storage Temperature Range	-94/+185	-70/+185	
Operating Temperature Range	-40/+185	-40/+85	

Electrical Specifications			
Performance Property	Units	US	(metric)
Cutoff Frequency	GHz		24.5
Velocity of Propagation	%		85
Dielectric Constant	NA		1.38
Time Delay	nS/ft (nS/m)	1.20	(3.92)
Impedance	ohms		50
Capacitance	pF/ft (pF/m)	23.9	(78.4)
Inductance	uH/ft (uH/m)	0.060	(0.20)
Shielding Effectiveness	dB		>90
DC Resistance			
Inner Conductor	ohms/1000ft (/km)	2.12	(7.0)
Outer Conductor	ohms/1000ft (/km)	2.21	(7.3)
Voltage Withstand	Volts DC		2000
Jacket Spark	Volts RMS		5000
Peak Power	kW		10

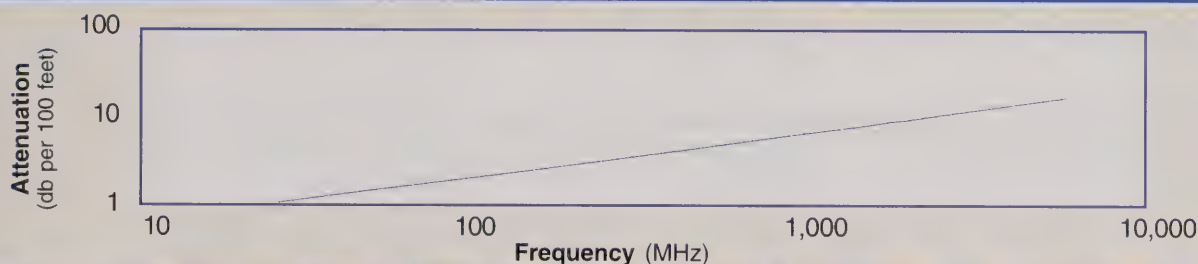
Mechanical Specifications

Performance Property	Units	US	(metric)
Bend Radius: installation	in. (mm)	0.88	(22.2)
Bend Radius: repeated	in. (mm)	3.0	(76.2)
Bending Moment	ft-lb (N-m)	0.38	(0.52)
Weight	lb/ft (kg/m)	0.055	(0.08)
Tensile Strength	lb (kg)	120	(54.5)
Flat Plate Crush	lb/in. (kg/mm)	30	(0.54)

TIMES MICROWAVE SYSTEMS

A Smiths Group plc company

Attenuation vs. Frequency (typical)



Frequency (MHz)	30	50	150	220	450	900	1500	1800	2000	2500	5800
Attenuation dB/100 ft	1.1	1.4	2.4	2.9	4.2	6.1	7.9	8.7	9.2	10.4	16.5
Attenuation dB/100 m	3.5	4.5	7.9	9.6	13.8	19.9	26.0	28.7	30.3	34.2	54.2
Avg. Power kW	2.09	1.62	0.92	0.76	0.52	0.36	0.28	0.25	0.24	0.21	0.13

Calculate Attenuation = $(0.191930) \cdot \sqrt{\text{FMHz}} + (0.000330) \cdot \text{FMHz}$ (interactive calculator available at <http://www.timesmicrowave/telecom>)
 Attenuation: VSWR=1.0; Ambient = +25°C (77°F) Power: VSWR=1.0; Ambient = +40°C; Inner Conductor = 100°C (212°F);
 Sea Level; dry air; atmospheric pressure; no solar loading



Connectors

Interface	Description	Part Number	Stock Code	VSWR** Freq. (GHz)	Coupling Nut	Inner Contact Attach	Outer Contact Attach	Finish* Body /Pin	Length in (mm)	Width in (mm)	Weight lb (g)
N Male	Straight Plug	TC-300-NM	3190-498	<1.25:1 (6)	Knurl	Solder	Crimp	NS	1.6 (41)	0.85 (21.6)	0.074 (33.8)
N Male	Right Angle	TC-300-NM-RA	3190-499	<1.35:1 (2.5)	Knurl	Solder	Crimp	NS	1.5 (38)	0.85 (21.6)	0.101 (45.8)
TNC Male	Straight Plug	TC-300-TM	3190-500	<1.25:1 (2.5)	Knurl	Solder	Crimp	NS	1.7 (43)	0.59 (15.0)	0.050 (22.7)
SMA Male	Straight Plug	TC-300-SM	3190-501	<1.25:1 (2.5)	Hex	Solder	Crimp	SS/G	1.0 (25)	0.35 (8.9)	0.018 (8.2)
SMA Female	Bulkhead Jack	TC-300-SF-BH	3190-590	<1.25:1 (2.5)	NA	Solder	Crimp	SS/G	1.1 (28)	0.31 (7.9)	0.022 (10.0)

* Finish metals: N=Nickel, S=Silver, G=Gold, SS=Stainless Steel, A=Alballoy **VSWR spec based on 3 foot cable with a connector pair

Hardware Accessories

Type	Part Number	Stock Code	Description
Ground Kit	GK-S300T	GK-S300T	Standard Ground Kit (each)

Install Tools

Type	Part Number	Stock Code	Description
Crimp Tool	CT-300/400	3190-666	Crimp tool for LMR-300 connectors
Cutting Tool	CCT-01	3190-1544	Cable end flush cut tool
Replacement Blades	RB-01	3190-1609	Replacement blades for cutting tool



TIMES MICROWAVE SYSTEMS

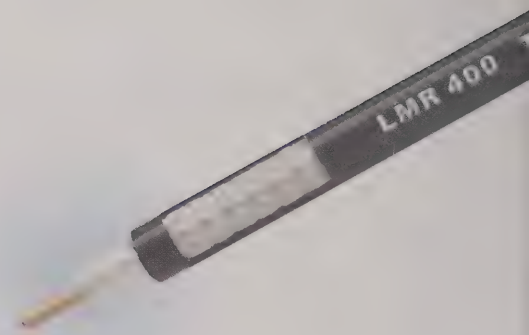
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LMR-400

Flexible Low Loss Communications Coax

Ideal for...

- Drop-in replacement for RG-8/9913 Air-Dielectric type Cable
- Jumper Assemblies in Wireless Communications Systems
- Short Antenna Feeder runs
- Any application (e.g. WLL, GPS, LMR) requiring an easily routed, low loss RF cable



- **LMR[®]** standard is a UV Resistant Polyethylene jacketed cable designed for 20-year service outdoor use. The bending and handling characteristics are significantly better than air-dielectric and corrugated hard-line cables.
- **LMR[®]-DB** is identical to standard LMR plus has the advantage of being watertight. The addition of waterproofing compound in and around the foil/braid insures continuous reliable service should the jacket be inadvertently damaged during installation or in the future.
- **LMR[®]-FR** is a non-halogen (non-toxic), low smoke, fire retardant cable designed for in-building runs that can be routed anywhere except air handling plenums. LMR-FR has a UL/NEC & CSA rating of 'CMR/MPR' and 'FT4' respectively.
- **LMR[®]-FR-PVC** is a general-purpose indoor cable and has a UL/NEC & CSA rating of 'CMR/MPR' and 'FT4' respectively. It is less expensive than LMR-FR, however it emits toxic fumes (HCL) and greater smoke density when burned.
- **LMR[®]-PVC** is designed for low loss general-purpose indoor/outdoor applications and is somewhat more flexible than the standard polyethylene jacketed LMR.
- **LMR[®]-PVC-W** is a white-jacketed version of LMR-PVC for marine and other indoor/outdoor applications where color compatibility is desired.

- **Flexibility** and bendability are hallmarks of the LMR-400 cable design. The flexible outer conductor enables the tightest bend radius available for any cable of similar size and performance.
- **Low Loss** is another hallmark feature of LMR-400. Size for size LMR has the lowest loss of any flexible cable and comparable loss to semirigid hard-line cables.

- **RF Shielding** is 50 dB greater than typical single shielded coax (40 dB). The multi-ply bonded foil outer conductor is rated conservatively at > 90 dB (i.e. >180 dB between two adjacent cables).
- **Weatherability:** LMR-400 cables designed for outdoor exposure incorporate the best materials for UV resistance and have life expectancy in excess of 20 years.
- **Connectors:** A wide variety of connectors are available for LMR-400 cable, including all common interface types, reverse polarity, and a choice of solder or non-solder center pins. Most LMR connectors employ crimp outer attachment using standard hex crimp sizes.
- **Cable Assemblies:** All LMR-400 cable types are available as pre-terminated cable assemblies. Refer to the section on FlexTech for further details.

Part Description				
Part No.	Application	Jacket	Color	Stock Code
LMR-400	Outdoor	PE	Black	54001
LMR-400-DB	Outdoor/Watertight	PE	Black	54091
LMR-400-FR	Indoor -Riser CMR	FRPE	Black	54030
LMR-400-FR-PVC	Indoor -Riser CMR	FRPVC	Black	54073
LMR-400-PVC	Indoor/Outdoor	PVC	Black	54218
LMR-400-PVC-W	Indoor/Outdoor	PVC	White	54204

Construction Specifications			
Description	Material	In.	(mm)
Inner Conductor	Solid BCCAl	0.108	(2.74)
Dielectric	Foam PE	0.285	(7.24)
Outer Conductor	Aluminum Tape	0.291	(7.39)
Overall Braid	Tinned Copper	0.320	(8.13)
Jacket	(see table above)	0.405	(10.29)

TLMR[®]

FLEXIBLE COMMUNICATIONS COAX

Low Loss
Communications Coax
Reference Chart





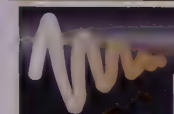
Communications Coax Selection Guide

Featuring **TIMES MICROWAVE SYSTEMS LMR®** Flexible Coax



Attenuation (dB per 100 feet ; +25C)

	2 1/4" LDF	1 5/8" LDF	1 1/4" LDF	LMR-1700	7/8" LDF	LMR-1200	LMR-900	1/2" LDF	LMR-600	LMR-500	1/2" SuperFlex	3/8" LDF	LMR-400	3/8" SuperFlex	9913	ULTRA-LINK™	RG213/ RG214	1/4" SuperFlex	LMR-300	LMR-240	RG8X	LMR-200	ULTRA-LINK	LMR-195	RG-58	LMR-100A
Frequency / Size	2.350"	1.980"	1.550"	1.670"	1.090"	1.200"	0.870"	0.630"	0.590"	0.500"	0.520"	0.440"	0.405"	0.415"	0.405"	0.405"	0.405"	0.300"	0.300"	0.240"	0.242"	0.195"	0.195"	0.195"	0.195"	0.110"
30 MHz	0.096*	0.120	0.147	0.149	0.197	0.209	0.288	0.369	0.421	0.54	0.561	0.567	0.7	0.654	0.8	0.7	1.2	0.98	1.1	1.3	2.0	1.8	2.5	1.9	2.5	3.9
50 MHz	0.125*	0.156	0.191	0.195	0.257	0.272	0.374	0.479	0.547	0.70	0.730	0.736	0.9	0.848	0.9	--	1.6	1.27	1.4	1.7	2.5	2.3	--	2.5	3.1	5.1
150 MHz	0.227*	0.280	0.340	0.347	0.458	0.481	0.658	0.845	0.964	1.22	1.29	1.30	1.5	1.49	1.6	1.5	2.8	2.23	2.4	3.0	4.7	4.0	5.1	4.3	6.2	8.9
220 MHz	0.281*	0.345*	0.416*	0.427	0.560*	0.589	0.803	1.05*	1.18	1.49	1.58*	1.59*	1.8	1.82*	--	--	3.5	2.72	2.9	3.7	6.0	4.8	--	5.2	7.4	10.9
450 MHz	0.422	0.515	0.617	0.632	0.834	0.864	1.17	1.51	1.72	2.17	2.32	2.30	2.7	2.66	2.8	2.7	5.2	3.93	4.2	5.3	8.6	7.0	9.5	7.5	10.6	15.8
700 MHz	--	--	--	0.809	--	1.10	1.48	--	2.18	2.77	--	--	3.42	--	--	--	--	--	5.1	6.6	--	8.7	--	9.4	--	20.0
900 MHz	0.641*	0.767*	0.912*	0.936	1.23*	1.27	1.70	2.21*	2.50	3.13	3.41*	3.36*	3.9	3.86*	4.2	4.19	8.0	5.67*	6.1	7.6	12.8	9.9	14.0	10.7	16.5	22.8
1,500 MHz	0.879*	1.050	1.22	1.26	1.66	1.69	2.24	2.93	3.31	4.13	4.57	4.43	5.1	5.12	5.6	--	--	7.47	7.9	9.9	--	12.9	--	13.4	--	30.0
2,000 MHz	1.058*	1.250	1.45	1.50	1.97	1.99	2.63	3.45	3.90	4.84	5.41	5.21	6.0	6.01	6.7	--	--	8.73	9.2	11.5	--	15.0	--	16.1	--	35.0
2,500 MHz	--	1.440	1.68*	1.71	2.27*	2.26	2.98	3.91*	4.42	5.48	6.17*	5.91*	6.8	6.84*	--	6.8*	--	9.85*	10.4	12.9	--	16.9	37.0*	18.1	--	40.0
5,800 MHz	--	--	--	--	--	--	4.90	--	7.30	8.90	--	--	10.8	--	--	--	--	--	16.6	20.4	--	26.4	--	28.3	--	64.1
Attenuation at Any Frequency = [k1 x √(Fmhz)] + [k2 x Fmhz] or use Performance Calculator at www.timesmicrowave.com																										
k1				0.02646		0.03737	0.05177		0.07555	0.09659			0.12229						0.19193	0.24208		0.32090		0.35686		0.70914
k2				0.00016		0.00016	0.00016		0.00026	0.00026			0.00026						0.00033	0.00033		0.00033		0.00047		0.00174
List Price \$/foot	21.24	15.86	11.82	\$ 7.80	6.08	\$ 4.85	\$ 3.70	2.65	\$ 1.30	\$ 1.05	3.88	1.98	\$.64	2.75	.75	.95	.95/1.60	1.73	\$.53	\$.47	0.55	\$.37	1.10	\$.37	0.40	\$.30



Power Handling (kW ; +40C ; Sea Level)

	2 1/4" LDF	1 5/8" LDF	1 1/4" LDF	LMR-1700	7/8" LDF	LMR-1200	LMR-900	1/2" LDF	LMR-600	LMR-500	1/2" SuperFlex	3/8" LDF	LMR-400	3/8" SuperFlex	9913	ULTRA-LINK	RG213/ RG214	1/4" SuperFlex	LMR-300	LMR-240	RG8X	LMR-200	ULTRA-LINK	LMR-195	RG-58	LMR-100A
Frequency / Size	2.350"	1.980"	1.550"	1.670"	1.090"	1.200"	0.870"	0.630"	0.590"	0.500"	0.520"	0.440"	0.405"	0.415"	0.405"	0.405"	0.405"	0.300"	0.300"	0.240"	0.242"	0.195"	0.195"	0.195"	0.195"	0.110"
30 MHz	39.5*	28.9	21.1	20.3	14.0	12.6	8.9	6.31	5.5	4.4	5.75	4.14	3.3	3.97	2.2	--	1.8	2.28	2.1	1.49	0.35	1.02	4.0	0.85	0.40	0.23
50 MHz	30.2*	22.1	16.2	15.6	10.7	9.7	6.8	4.85	4.3	3.4	4.42	3.19	2.6	3.06	1.7	--	1.2	1.76	1.6	1.15	0.28	0.79	--	0.66	0.30	0.18
150 MHz	16.7*	12.3	9.09	8.7	6.04	5.5	3.9	2.75	2.4	1.9	2.49	1.81	1.5	1.74	0.90	--	0.62	1.00	0.93	0.66	0.15	0.45	2.0	0.38	0.16	0.10
220 MHz	13.5*	13.5*	7.45*	7.1	4.94*	4.5	3.2	2.23*	1.9	1.6	2.04*	1.49*	1.2	1.44*	--	--	--	0.825*	0.76	0.54	--	0.37	--	0.31	--	0.08
450 MHz	8.91	6.71	5.01	4.8	3.32	3.1	2.2	1.53	1.3	1.1	1.38	1.02	0.83	0.975	0.45	--	0.30	0.567	0.52	0.38	0.08	0.26	1.0	0.21	0.08	0.06
700 MHz	--	--	--	3.8	--	2.4	1.7	--	1.1	0.85	--	--	0.66	--	--	--	--	--	0.43	0.30	--	0.21	--	0.17	--	0.05
900 MHz	5.90*	4.49*	3.39*	3.3	2.24	2.1	1.5	1.05*	0.93	0.75	0.944*	0.703*	0.58	0.674*	0.28	--	0.18	0.393*	0.36	0.26	0.05	0.18	0.65	0.15	0.05	0.040
1,500 MHz	4.29*	3.30	2.52	2.4	1.66	1.6	1.1	0.793	0.70	0.57	0.705	0.530	0.44	0.507	0.20	--	--	0.299	0.28	0.20	--	0.14	--	0.12	--	0.030
2,000 MHz	3.57*	2.76	2.13	2.0	1.40	1.3	1.0	0.673	0.59	0.49	0.597	0.451	0.37	0.431	0.16	--	--	0.256	0.24	0.17	--	0.12	--	0.10	--	0.025
2,500 MHz	--	2.40	1.84*	1.8	1.21*	1.2	0.9	0.594*	0.52	0.43	0.547*	0.398*	0.33	0.379*	--	--	--	0.225*	0.21	0.15	--	0.10	--	0.09	--	0.020
5,800 MHz	--	--	--	--	--	--	0.52	--	0.32	0.26	--	--	0.21	--	--	--	--	--	0.13	0.10	--	0.07	--	0.06	--	0.010



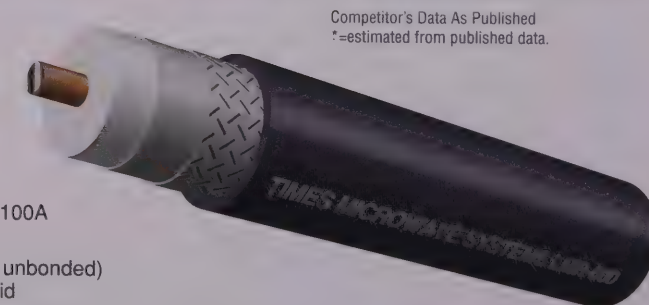
General Performance Properties

	LMR-1700	LMR-1200	LMR-900	LMR-600	LMR-500	LMR-400	LMR-300	LMR-240	LMR-200	LMR-195	LMR-100A
Conductor: (note 1)	0.527"	0.349"	0.262"	0.176"	0.142"	0.109"	0.070"	0.056"	0.044"	0.037"	0.018"
Dielectric: Cellular PE (note 2)	1.350"	0.920"	0.680"	0.455"	0.370"	0.285"	0.190"	0.150"	0.116"	0.110"	0.060"
Shield: Aluminum Tape (note 3)	1.356"	0.926"	0.686"	0.461"	0.376"	0.291"	0.196"	0.155"	0.121"	0.116"	0.065"
Tinned Copper Braid	1.402"	0.972"	0.732"	0.490"	0.405"	0.320"	0.225"	0.178"	0.144"	0.139"	0.083"
Jacket: Black PE (note 4)	1.670"	1.200"	0.870"	0.590"	0.500"	0.405"	0.300"	0.240"	0.195"	0.195"	0.110"
Bend Radius (note 5)	13.5"	6.5"	3"	1.5"	1.25"	1"	.875"	0.75"	0.50"	0.50"	0.25"
Weight(lbs/foot)	0.736	0.448	0.266	0.131	0.097	0.068	0.055	0.034	0.022	0.022	0.015
Temperature Range	-40°C to +85°C										
Impedance	50 Ohms										
Velocity (%)	89	88	87	87	86	85	85	84	83	80	66
Capacitance (pF per Foot)	22.8	23.1	23.4	23.4	23.6	23.9	24.1	24.2	24.5	24.3	30.8
DC Resistance: center conductor (ohms/1000') : shield	0.21	0.32	0.54	0.53	0.82	1.39	2.12	3.20	5.36	7.58	81.0
Shielding	0.27	0.37	0.55	1.20	1.27	1.65	2.21	3.89	4.90	4.90	9.5
Phase Stability	> 90 db +/- 10 ppm/degC										

NOTES:

- (1) Center Conductor in LMR-900, LMR-1200 & LMR-1700 is Copper Tube
Center Conductor in LMR-400, LMR-500 & LMR-600 is Copper Clad Aluminum
Center Conductor in LMR-195, LMR-200, LMR-240 and LMR-300 is Bare Copper
LMR-100A is BCCS
- (2) Low loss closed cell polyethylene foam (LMR-100A solid polyethylene)
- (3) Aluminum laminated tape bonded (LMR-100A unbonded) to the Dielectric with a Tinned Copper Overbraid
- (4) Black UV protected polyethylene (LMR-100A black PVC)
- (5) Less than 1 ohm impedance change at bend

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Competitor's Data As Published
* = estimated from published data.



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Benefits of LMR Cable

Flexible:	More flexible than corrugated copper cables often eliminating the need for jumper cables.
Low Cost:	The most cost effective choice for antenna feeders and jumper cables.
Easy Connector Attachment:	Connectors suitable for quick field attachment using common hand tools or available stripping tools.
Low Loss:	Loss comparable to corrugated copper cables.
Weatherproof:	Black UV protected polyethylene jacket for long term outdoor exposure. LMR-DB watertight construction standard on LMR-900, -1200, -1700 (optional on LMR-195 through -600). Connectors provided with gaskets and shrink boots. Bonded aluminum tape resists moisture ingress.

LMR® Connectors



	LMR-200	LMR-240	LMR-300	LMR-400	LMR-500	LMR-600	LMR-900	LMR-1200	LMR-1700
N (plug)	✓	✓	✓	✓	✓	✓	✓	✓	✓
N (plug)-RP	✓			✓					
N (jack)				✓	✓	✓	✓	✓	✓
N (rt. angle)			✓	✓	✓	✓			
UHF (plug)		✓		✓	✓	✓			
Mini UHF	✓	✓		✓					
BNC (plug)	✓	✓		✓					
TNC (plug)	✓	✓	✓	✓	✓	✓			
TNC (plug)-RP	✓	✓		✓		✓			
TNC (plug) RA		✓		✓					
TNC (jack)	✓								
TNC (jack)-RP	✓			✓		✓			
SMA (plug)	✓	✓	✓	✓					
SMA RP	✓	✓							
SMA RA		✓							
7/16 DIN (plug)				✓		✓	✓	✓	✓
7/16 DIN (jack)				✓		✓	✓	✓	✓
7/16 DIN Bulkhead (jack)									
7/16 90° (plug)						✓	✓		
7/8 EIA Flange						✓	✓	✓	

Please consult TMS for other connector requirements

Special LMR Products

LMR-DB:	Watertight flexible coax meets Industry Standard watertightness tests ASTM D4565, REA PE39, ANSI S-84-608 while maintaining the same excellent performance properties as standard LMR. The inert flooding compound completely eliminates all paths of water migration and ingress for long term reliability (10 year warranty).
LMR-FR Riser and LMR-LLPL Plenum Fire Retardant Cables:	The LMR-FR cables have fire retardant, low smoke, non-halogenated jackets. The jackets are UV protected to allow installation outdoors or indoors. They provide identical electrical performance to standard LMR cables. They are UL/CSA 'CMR/MPR (PCC-FT4)' listed for installation in risers and are approved for use by the London Underground. LMR-LLPL is UL/CSA 'CMP/MPP (PCC-FT6)' listed for indoor use in air handling plenums, where maximum fire retardancy and minimum smoke generation are dictated.
LMR-UltraFlex:	A stranded center conductor and a more flexible jacket make LMR-UltraFlex ideal for applications requiring repeat bending. Available sizes include 240, 400, and newly introduced 500 and 600. Attenuation is about 15% higher than for standard LMR cables. LMR-UltraFlex cable accepts standard LMR connectors.
LMR-MA Mobile Antenna Cables:	The MA or mobile antenna versions of the LMR cables provide improved performance compared to RG-58 for mobile antenna feeders in high frequency applications. The LMR-MA cables feature PVC jackets for better flexibility and easier installation and non-bonded outer conductor tape for ease of connector attachment.
75 Ohm Versions:	Please consult TMS for further details.
E-Z Connectors:	The EZ series of connectors are the quickest and easiest to install high performance connectors available. They utilize push on center contacts to eliminate soldering. They are available for LMR-400, 600, 900, 1200 and 1700 cables.
Prep Tools:	Available for LMR-400, 500, 600, 900, 1200 and 1700. Easily strips cable for consistent high quality assemblies.
Cable Assemblies:	FlexTech™ factory fabricated with LMR-DB watertight cable, weather sealed and 100% sweep tested for VSWR and Insertion Loss.
Hardware Accessories:	A complete line of supporting hardware, including ground kits, hoisting grips, snap-in hangers, support blocks, entry panels and weatherproofing kits are available.



TIMES MICROWAVE SYSTEMS - THE COAX LEADER

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www.timesmicrowave.com

Mechanical Specifications

Performance Property	Units	US	(metric)
Bend Radius: installation	in. (mm)	1.00	(25.4)
Bend Radius: repeated	in. (mm)	4.0	(101.6)
Bending Moment	ft-lb (N-m)	0.5	(0.68)
Weight	lb/ft (kg/m)	0.068	(0.10)
Tensile Strength	lb (kg)	160	(72.6)
Flat Plate Crush	lb/in. (kg/mm)	40	(0.71)

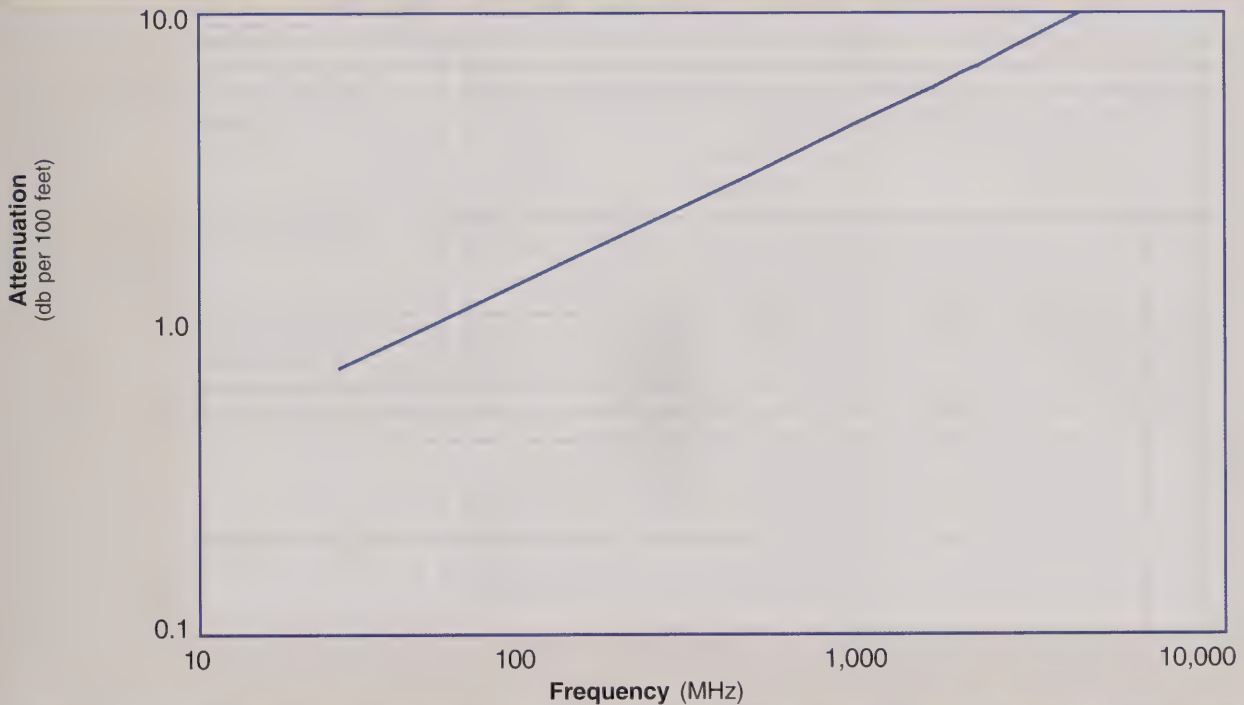
Environmental Specifications

Performance Property	°F	°C
Installation Temperature Range	-40/+185	-40/+85
Storage Temperature Range	-94/+185	-70/+185
Operating Temperature Range	-40/+185	-40/+85

Electrical Specifications

Performance Property	Units	US	(metric)
Cutoff Frequency	GHz	16.2	
Velocity of Propagation	%	85	
Dielectric Constant	NA	1.38	
Time Delay	nS/ft (nS/m)	1.20	(3.92)
Impedance	ohms	50	
Capacitance	pF/ft (pF/m)	23.9	(78.4)
Inductance	uH/ft (uH/m)	0.060	(0.20)
Shielding Effectiveness	dB	>90	
DC Resistance			
Inner Conductor	ohms/1000ft (/km)	1.39	(4.6)
Outer Conductor	ohms/1000ft (/km)	1.65	(5.4)
Voltage Withstand	Volts DC	2500	
Jacket Spark	Volts RMS	8000	
Peak Power	kW	16	

Attenuation vs. Frequency (typical)



Frequency (MHz)	30	50	150	220	450	900	1500	1800	2000	2500	5800
Attenuation dB/100 ft	0.7	0.9	1.5	1.9	2.7	3.9	5.1	5.7	6.0	6.8	10.8
Attenuation dB/100 m	2.2	2.9	5.0	6.1	8.9	12.8	16.8	18.6	19.6	22.2	35.5
Avg. Power kW	3.33	2.57	1.47	1.20	0.83	0.58	0.44	0.40	0.37	0.33	0.21

Calculate Attenuation =

$(0.122290) \cdot \sqrt{\text{FMHz}} + (0.000260) \cdot \text{FMHz}$ (interactive calculator available at <http://www.timesmicrowave/telecom>)

Attenuation:

VSWR=1.0 ; Ambient = +25°C (77°F)

Power:

VSWR=1.0; Ambient = +40°C; Inner Conductor = 100°C (212°F); Sea Level; dry air; atmospheric pressure; no solar loading

TIMES MICROWAVE SYSTEMS

A Smiths Group plc company

LMR-400

Flexible Low Loss Communications Coax



Connectors

Interface	Description	Part Number	Stock Code	VSWR** Freq. (GHz)	Coupling Nut	Inner Contact Attach	Outer Contact Attach	Finish* Body /Pin	Length in (mm)	Width in (mm)	Weight lb (g)
N Male	Straight Plug	SC-400-NM	3190-1454	<1.25:1 (25)	Knurl	Solder	Crimp	NG	1.5 (38)	0.75 (19.1)	0.090 (40.8)
	Straight Plug	TC-400-NM	3190-188	<1.25:1 (25)	Knurl	Solder	Crimp	NG	1.5 (38)	0.75 (19.1)	0.090 (40.8)
	Straight Plug	TC-400-NMC	3190-277	<1.25:1 (25)	Knurl	Solder	Clamp	NG	1.5 (38)	0.75 (19.1)	0.121 (54.9)
	Straight Plug	EZ-400-NMH	3190-400	<1.25:1 (10)	Hex	Spring Finger	Crimp	S/G	1.5 (38)	0.89 (22.6)	0.113 (51.3)
	Straight Plug	TC-400-NMH	3190-552	<1.25:1 (10)	Hex	Solder	Crimp	S/G	1.5 (38)	0.89 (22.6)	0.113 (51.3)
	Straight Plug	TC-400-NMK	3190-661	<1.25:1 (10)	Knurl	Spring Finger	Crimp	S/G	1.5 (38)	0.89 (22.6)	0.113 (51.3)
	Right Angle	TC-400-NMH-RA	3190-422	<1.35:1 (6)	Hex	Solder	Crimp	SG	1.8 (46)	1.25 (31.8)	0.130 (59.0)
	Right Angle	TC-400-NMC-RA (A)	3190-870	<1.35:1 (25)	Hex	Solder	Clamp	AG	1.8 (46)	1.25 (31.8)	0.150 (68.0)
	Right Angle	EZ-400-NMH-RA	3190-761	<1.35:1 (25)	Hex	Spring Finger	Crimp	SG	1.8 (46)	1.25 (31.8)	0.130 (59.0)
	Reverse Polarity	TC-400-NM-RP	3190-960	<1.25:1 (25)	Knurl	Solder	Crimp	NG	1.5 (38)	0.75 (19.1)	0.090 (40.8)
N Female	Straight Jack	TC-400-NFC	3190-299	<1.25:1 (25)	NA	Solder	Clamp	NS	1.6 (41)	0.75 (19.1)	0.119 (54.0)
	Straight Jack	EZ-400-NF	3190-956	<1.25:1 (25)	NA	Spring Finger	Crimp	NG	1.8 (45)	0.66 (16.8)	0.105 (47.6)
	Bulkhead Jack	EZ-400-NF-BH	3190-518	<1.25:1 (25)	NA	Spring Finger	Crimp	NG	1.8 (46)	0.88 (22.4)	0.102 (46.3)
	Bulkhead Jack	TC-400-NFC-BH (A)	3190-872	<1.25:1 (25)	NA	Solder	Clamp	AG	1.8 (46)	0.88 (22.4)	0.145 (65.8)
TNC Male	Straight Plug	TC-400-TM	3190-260	<1.25:1 (25)	Knurl	Solder	Crimp	NS	1.7 (43)	0.59 (15.0)	0.074 (33.6)
	Straight Plug	EZ-400-TM	3190-650	<1.25:1 (25)	Knurl	Spring Finger	Crimp	NS	1.7 (43)	0.59 (15.0)	0.074 (33.6)
	Right Angle	TC-400-TM-RA	3190-442	<1.35:1 (25)	Knurl	Solder	Crimp	NG	1.7 (43)	0.59 (15.0)	0.085 (38.6)
	Reverse Polarity	EZ-400-TM-RP	3190-794	<1.25:1 (25)	Knurl	Spring Finger	Crimp	AG	1.7 (43)	0.59 (15.0)	0.074 (33.6)
TNC Female	Reverse Polarity	EZ-400-TF-RP	3190-795	<1.25:1 (25)	NA	Spring Finger	Crimp	AG	1.8 (46)	0.55 (14.0)	0.074 (33.6)
SMA Male	Straight Plug	TC-400-SM	3190-439	<1.25:1 (6)	Hex	Solder	Crimp	NG	1.2 (29)	0.50 (12.7)	0.032 (14.5)
BNC Male	Straight Plug	TC-400-BM	3190-318	<1.25:1 (25)	Knurl	Solder	Crimp	NS	1.7 (43)	0.56 (14.2)	0.063 (28.6)
Mini-UHF	Straight Plug	TC-400-MUHF	3190-520	<1.25:1 (25)	Knurl	Solder	Crimp	NG	1.1 (28)	0.50 (12.7)	0.020 (9.1)
UHF Male	Straight Plug	EZ-400-UM	3190-997	<1.25:1 (25)	Knurl	Spring Finger	Crimp	NG	1.9 (48)	0.80 (20.3)	0.090 (40.8)
7-16 DIN Male	Straight Plug	TC-400-716-MC	3190-279	<1.25:1 (25)	Hex	Solder	Clamp	SS	1.4 (36)	1.40 (35.6)	0.268 (121.6)
7-16 DIN Female	Straight Jack	TC-400-716-FC	3190-376	<1.25:1 (25)	NA	Solder	Clamp	SS	1.6 (41)	1.13 (28.7)	0.281 (127.5)

* Finish metals: N=Nickel, S=Silver, G=Gold, SS=Stainless Steel, A=Alballoy **VSWR spec based on 3 foot cable with a connector pair



Hardware Accessories

Type	Part Number	Stock Code	Description
Ground Kit	GK-S400T	GK-S400T	Standard Grounding Kit (each)
Hoisting Grip	HG-400T	HG-400T	Laced Type (each)



Install Tools

Type	Part Number	Stock Code	Description
Crimp Tool	HX-4	3190-200	Crimp Handle
Crimp Dies	Y1719	3190-202	.429" Hex Dies
Crimp Tool	CT-400/300	3190-666	Crimp tool for LMR 400 connectors
Crimp Rings	CR-400	3190-830	Crimp rings for TC/EZ-400 connectors (package of 10)
Strip Tool	ST-400C	3190-228	For Clamp Connectors
Strip Tool	ST-400EZ	3190-401	For Crimp Connectors
Deburr Tool	DBT-01	3190-406	Removes center conductor rough edges
Cutting Tool	CCT-01	3190-1544	Cable end flush cut tool
Replacement Blades	RB-01	3190-1609	Replacement blades for cutting tool
Tool Kit	TK-400EZ	3190-1602	Tool kit for LMR-400 Crimp Connectors (includes CCT-01, ST-400EZ, CT-400/300, DBT-01, Tool Pouch)

TIMES MICROWAVE SYSTEMS

A Smiths Group plc company

LMR-500

Flexible Low Loss Communications Coax

Ideal for...

- Jumper Assemblies in Wireless Communications Systems
- Short Antenna Feeder runs
- Any application (e.g. WLL, LMR, Paging, PCS, Cellular) requiring an easily routed, low loss RF cable

• **LMR® standard** is a UV Resistant Polyethylene jacketed cable designed for 20-year service outdoor use. The bending and handling characteristics are significantly better than air-dielectric and corrugated hard-line cables.

• **LMR® - DB** is identical to standard LMR plus has the advantage of being watertight. The addition of waterproofing compound in and around the foil/braid insures continuous reliable service should the jacket be inadvertently damaged during installation or in the future.

• **LMR® - FR** is a non-halogen (non-toxic), low smoke, fire retardant cable designed for in-building runs that can be routed anywhere except air handling plenums. LMR-FR has a UL/NEC & CSA rating of 'CMR/MPR' and 'FT4' respectively.

• **Flexibility** and bendability are hallmarks of the LMR-500 cable design. The flexible outer conductor enables the tightest bend radius available for any cable of similar size and performance.

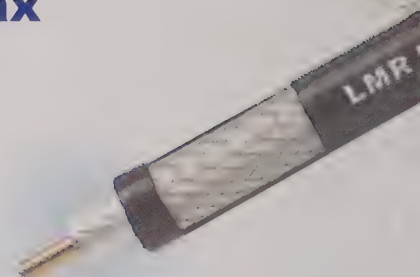
• **Low Loss** is another hallmark feature of LMR-500. Size for size LMR has the lowest loss of any flexible cable and comparable loss to semirigid hard-line cables.

• **RF Shielding** is 50 dB greater than typical single shielded coax (40 dB). The multi-ply bonded foil outer conductor is rated conservatively at > 90 dB (i.e. >180 dB between two adjacent cables).

• **Weatherability:** LMR-500 cables designed for outdoor exposure incorporate the best materials for UV resistance and have life expectancy in excess of 20 years.

• **Connectors:** A wide variety of connectors are available for LMR-500 cable, including all common interface types, reverse polarity, and a choice of solder or non-solder center pins. Most LMR connectors employ crimp outer attachment using standard hex crimp sizes.

• **Cable Assemblies:** All LMR-500 cable types are available as pre-terminated cable assemblies. Refer to the section on FlexTech for further details.



Part Description				Stock Code
Part No.	Application	Jacket	Color	
LMR-500	Outdoor	PE	Black	54002
LMR-500-DB	Outdoor/Watertight	PE	Black	54092
LMR-500-FR	Indoor -Riser CMR	FRPE	Black	54031

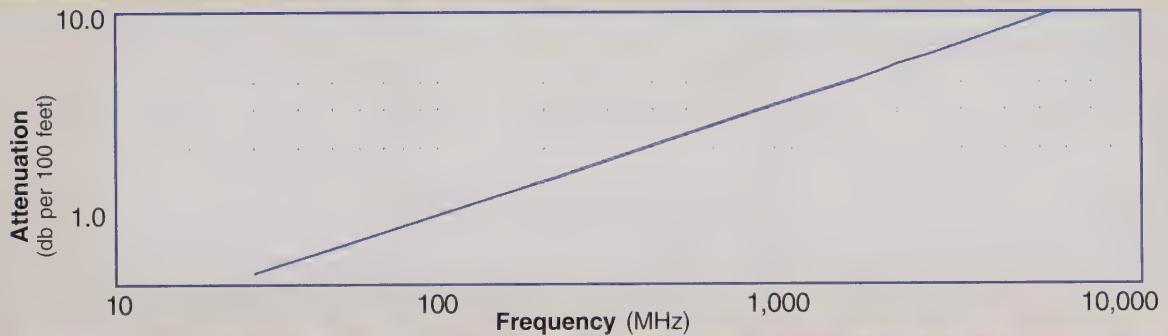
Construction Specifications			
Description	Material	In.	(mm)
Inner Conductor	Solid BCCA1	0.142	(3.61)
Dielectric	Foam PE	0.370	(9.40)
Outer Conductor	Aluminum Tape	0.376	(9.55)
Overall Braid	Tinned Copper	0.405	(10.29)
Jacket	(see table above)	0.500	(12.70)

Mechanical Specifications			
Performance Property	Units	US	(metric)
Bend Radius: installation	in. (mm)	1.25	(31.8)
Bend Radius: repeated	in. (mm)	5.0	(127.0)
Bending Moment	ft-lb (N-m)	1.75	(2.37)
Weight	lb/ft (kg/m)	0.097	(0.14)
Tensile Strength	lb (kg)	260	(118.0)
Flat Plate Crush	lb/in. (kg/mm)	50	(0.89)

Environmental Specifications			
Performance Property	°F	°C	
Installation Temperature Range	-40/+185	-40/+85	
Storage Temperature Range	-94/+185	-70/+185	
Operating Temperature Range	-40/+185	-40/+85	

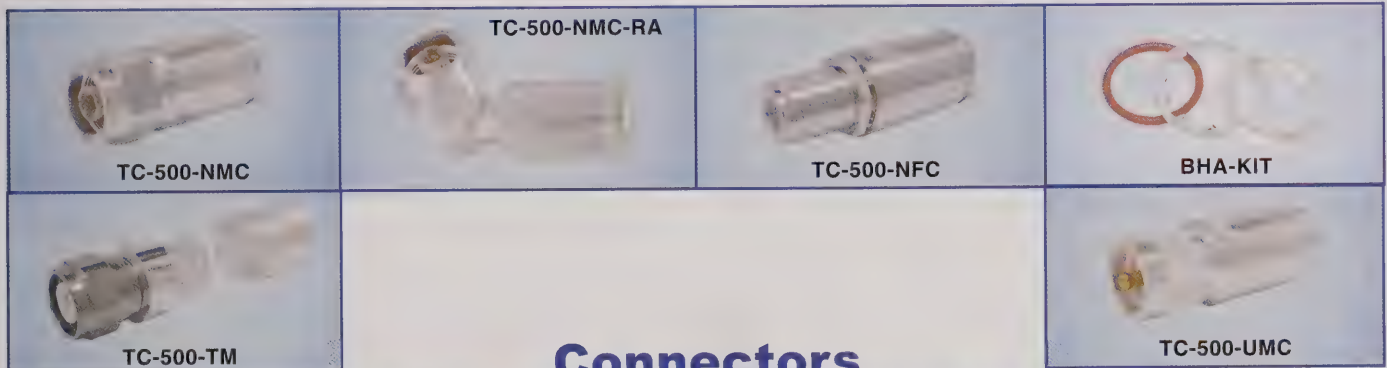
Electrical Specifications			
Performance Property	Units	US	(metric)
Cutoff Frequency	GHz	12.6	
Velocity of Propagation	%	86	
Dielectric Constant	NA	1.35	
Time Delay	nS/ft (nS/m)	1.18	(3.88)
Impedance	ohms	50	
Capacitance	pF/ft (pF/m)	23.6	(77.5)
Inductance	uH/ft (uH/m)	0.059	(0.19)
Shielding Effectiveness	dB	>90	
DC Resistance			
Inner Conductor	ohms/1000ft (/km)	0.82	(2.7)
Outer Conductor	ohms/1000ft (/km)	1.27	(4.2)
Voltage Withstand	Volts DC	3000	
Jacket Spark	Volts RMS	8000	
Peak Power	kW	22	

Attenuation vs. Frequency (typical)



Frequency (MHz)	30	50	150	220	450	900	1500	1800	2000	2500	5800
Attenuation dB/100 ft	0.5	0.7	1.2	1.5	2.2	3.1	4.1	4.6	4.8	5.5	8.9
Attenuation dB/100 m	1.8	2.3	4.0	4.9	7.1	10.3	13.6	15.0	15.9	18.0	29.1
Avg. Power kW	4.400	3.393	1.931	1.583	1.088	0.752	0.569	0.515	0.485	0.428	0.264

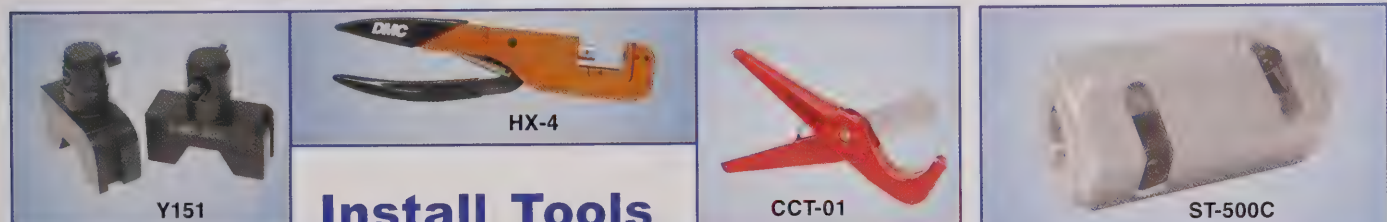
Calculate Attenuation = $(0.096590) \cdot \sqrt{\text{FMHz}} + (0.000260) \cdot \text{FMHz}$ (interactive calculator available at <http://www.timesmicrowave/telecom>)
 Attenuation: VSWR=1.0; Ambient = +25°C (77°F) Power: VSWR=1.0; Ambient = +40°C; Inner Conductor = 100°C (212°F);
 Sea Level; dry air; atmospheric pressure; no solar loading



Connectors

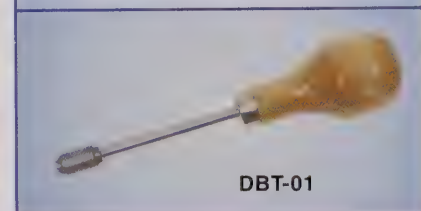
Interface	Description	Part Number	Stock Code	VSWR Freq. (GHz)	Coupling Nut	Inner Contact Attach	Outer Contact Attach	Finish* Body /Pin	Length in (mm)	Width in (mm)	Weight lb (g)
N Male	Straight Plug	TC-500-NMC	3190-377	<1.25:1 (2.5)	Hex	Solder	Clamp	S/G	2.1 (53)	0.92 (23.4)	0.228 (103.4)
	Right Angle	TC-500-NMC-RA	3190-227	<1.25:1 (2.5)	Hex	Solder	Clamp	S/G	2.4 (61)	1.5 (38.1)	0.275 (124.7)
N Female	Straight Jack	TC-500-NFC	3190-215	<1.25:1 (2.5)	NA	Solder	Clamp	S/G	2.2 (56)	0.94 (23.9)	0.215 (97.5)
	Bulkhead Kit	BHA-KIT	3190-223	<1.25:1 (2.5)	NA	NA	NA	NA	NA	NA	0.014 (6.4)
TNC Male	Straight Plug	TC-500-TM	3190-464	<1.25:1 (2.5)	Hex	Solder	Crimp	NG	1.5 (38)	0.62 (15.7)	0.082 (28.1)
UHF Male	Straight Plug	TC-500-UMC	3190-354	<1.25:1 (2.5)	Knurl	Solder	Clamp	S/G	2.1 (53)	0.88 (22.4)	0.215 (97.5)

* Finish metals: N=Nickel, S=Silver, G=Gold, SS=Stainless Steel, A=Alballoy



Install Tools

Type	Part Number	Stock Code	Description
Crimp Tool	HX-4	3190-200	Crimp Handle
Crimp Dies	Y151	3190-465	.532" Hex Dies
Strip Tool	ST-500C	3190-229	For Clamp Style Connectors
Deburr Tool	DBT-01	3190-406	Removes center conductor rough edges
Cutting Tool	CCT-01	3190-1544	Cable end flush cut tool
Replacement Blades	RB-01	3190-1609	Replacement blades for cutting tool



TIMES MICROWAVE SYSTEMS

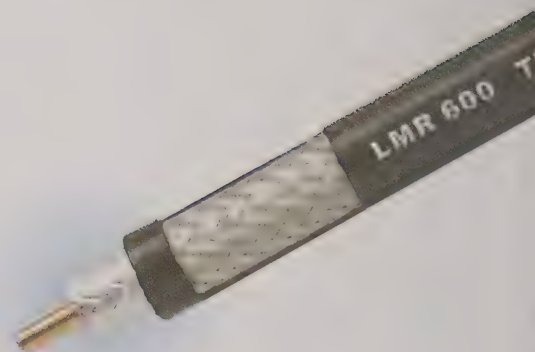
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LMR-600

Flexible Low Loss Communications Coax

Ideal for...

- Jumper Assemblies in Wireless Communications Systems
- Short Antenna Feeder runs
- Any application (e.g. WLL, LMR, Paging, PCS, Cellular) requiring an easily routed, low loss RF cable



• **LMR®** standard is a UV Resistant Polyethylene jacketed cable designed for 20-year service outdoor use. The bending and handling characteristics are significantly better than air-dielectric and corrugated hard-line cables.

• **LMR® - DB** is identical to standard LMR plus has the advantage of being watertight. The addition of waterproofing compound in and around the foil/braid insures continuous reliable service should the jacket be inadvertently damaged during installation or in the future.

• **LMR® - FR** is a non-halogen (non-toxic), low smoke, fire retardant cable designed for in-building runs that can be routed anywhere except air handling plenums. LMR-FR has a UL/NEC & CSA rating of 'CMR/MPR' and 'FT4' respectively.

• **LMR® - FR-PVC** is a general-purpose indoor cable and has a UL/NEC & CSA rating of 'CMR/MPR' and 'FT4' respectively. It is less expensive than LMR-FR, however it emits toxic fumes (HCL) and greater smoke density when burned.

• **LMR® - PVC** is designed for low loss general-purpose indoor/outdoor applications and is somewhat more flexible than the standard polyethylene jacketed LMR.

• **LMR® - PVC-W** is a white-jacketed version of LMR-PVC for marine and other indoor/outdoor applications where color compatibility is desired.

• **Flexibility** and bendability are hallmarks of the LMR-600 cable design. The flexible outer conductor enables the tightest bend radius available for any cable of similar size and performance.

• **Low Loss** is another hallmark feature of LMR-600. Size for size LMR has the lowest loss of any flexible cable and comparable loss to semirigid hard-line cables.

• **RF Shielding** is 50 dB greater than typical single shielded coax (40 dB). The multi-ply bonded foil outer conductor is rated conservatively at > 90 dB (i.e. >180 dB between two adjacent cables).

• **Weatherability:** LMR-600 cables designed for outdoor exposure incorporate the best materials for UV resistance and have life expectancy in excess of 20 years.

• **Connectors:** A wide variety of connectors are available for LMR-600 cable, including all common interface types, reverse polarity, and a choice of solder or non-solder center pins. Most LMR connectors employ crimp outer attachment using standard hex crimp sizes.

• **Cable Assemblies:** All LMR-600 cable types are available as pre-terminated cable assemblies. Refer to the section on FlexTech for further details.

Part Description				
Part Number	Application	Jacket	Color	Stock Code
LMR-600	Outdoor	PE	Black	54003
LMR-600-DB	Outdoor/Watertight	PE	Black	54093
LMR-600-FR	Indoor -Riser CMR	FRPE	Black	54032
LMR-600-FR-PVC	Indoor -Riser CMR	FRPVC	Black	54074
LMR-600-PVC	Indoor/Outdoor	PVC	Black	54219
LMR-600-PVC-W	Indoor/Outdoor	PVC	White	54206

Construction Specifications			
Description	Material	In.	(mm)
Inner Conductor	Solid BCCA1	0.176	(4.47)
Dielectric	Foam PE	0.455	(11.56)
Outer Conductor	Aluminum Tape	0.461	(11.71)
Overall Braid	Tinned Copper	0.490	(12.45)
Jacket	(see table above)	0.590	(14.99)

Mechanical Specifications

Performance Property	Units	US	(metric)
Bend Radius: installation	in. (mm)	1.50	(38.1)
Bend Radius: repeated	in. (mm)	6.0	(152.4)
Bending Moment	ft-lb (N-m)	2.75	(3.73)
Weight	lb/ft (kg/m)	0.131	(0.20)
Tensile Strength	lb (kg)	350	(158.9)
Flat Plate Crush	lb/in. (kg/mm)	60	(1.07)

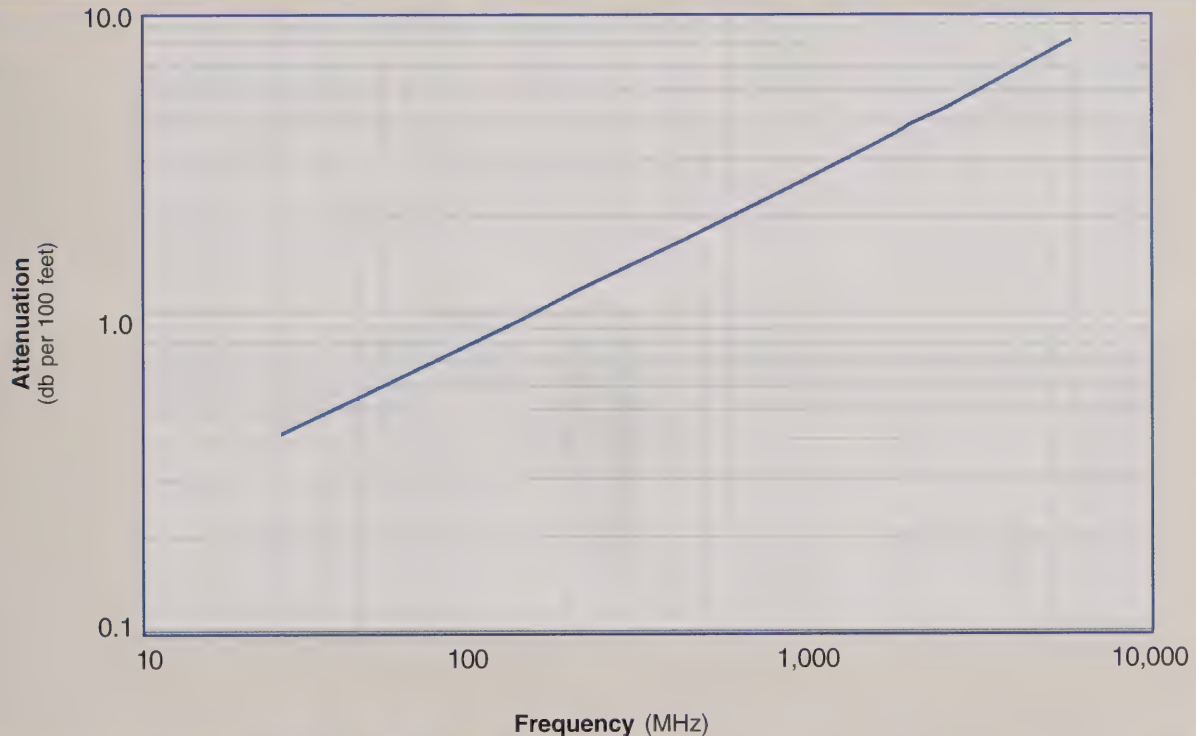
Environmental Specifications

Performance Property	°F	°C
Installation Temperature Range	-40/+185	-40/+85
Storage Temperature Range	-94/+185	-70/+185
Operating Temperature Range	-40/+185	-40/+85

Electrical Specifications

Performance Property	Units	US	(metric)
Cutoff Frequency	GHz	10.3	
Velocity of Propagation	%	87	
Dielectric Constant	NA	1.32	
Time Delay	nS/ft (nS/m)	1.17	(3.83)
Impedance	ohms	50	
Capacitance	pF/ft (pF/m)	23.4	(76.6)
Inductance	uH/ft (uH/m)	0.058	(0.19)
Shielding Effectiveness	dB	>90	
DC Resistance			
Inner Conductor	ohms/1000ft (/km)	0.53	(1.7)
Outer Conductor	ohms/1000ft (/km)	1.2	(3.9)
Voltage Withstand	Volts DC	4000	
Jacket Spark	Volts RMS	8000	
Peak Power	kW	40	

Attenuation vs. Frequency (typical)



Frequency (MHz)	30	50	150	220	450	900	1500	1800	2000	2500	5800
Attenuation dB/100 ft	0.4	0.5	1.0	1.2	1.7	2.5	3.3	3.7	3.9	4.4	7.3
Attenuation dB/100 m	1.4	1.8	3.2	3.9	5.6	8.2	10.9	12.1	12.8	14.5	23.8
Avg. Power kW	5.51	4.24	2.41	1.97	1.35	0.93	0.70	0.63	0.59	0.52	0.32

Calculate Attenuation =

$(0.075550) \cdot \sqrt{\text{FMHz}} + (0.000260) \cdot \text{FMHz}$ (interactive calculator available at <http://www.timesmicrowave/telecom>)

Attenuation:

VSWR=1.0; Ambient = +25°C (77°F)

Power:

VSWR=1.0; Ambient = +40°C; Inner Conductor = 100°C (212°F); Sea Level; dry air; atmospheric pressure; no solar loading

TIMES MICROWAVE SYSTEMS

A Smiths Group plc company

LMR-600

Flexible Low Loss Communications Coax



Connectors

Interface	Description	Part Number	Stock Code	VSWR** Freq. (GHz)	Coupling Nut	Inner Contact Attach	Outer Contact Attach	Finish* Body /Pin	Length in (mm)	Width in (mm)	Weight lb (g)
N Male	Straight Plug	EZ-600-NMH-B	3190-1268	<1.25:1 (8)	Hex	Spring Finger	Crimp	S/G	2.1 (53)	0.92 (23.4)	1.164 (74.4)
	Straight Plug	EZ-600-NMK	3190-669	<1.25:1 (2.5)	Knurl	Spring Finger	Crimp	S/G	2.1 (53)	0.92 (23.4)	1.164 (74.4)
	Straight Plug	TC-600-NMH	3190-208	<1.25:1 (2.5)	Hex	Solder	Crimp	S/G	2.1 (53)	0.92 (23.4)	0.166 (75.3)
	Straight Plug	EZ-600-NMC-2	3190-1387	<1.25:1 (6)	Hex	Spring Finger	Clamp	SG	2.1 (53)	0.92 (23.4)	0.202 (91.6)
	Straight Plug	TC-600-NMC	3190-357	<1.25:1 (2.5)	Hex	Solder	Clamp	SG	2.1 (53)	0.92 (23.4)	0.208 (93.4)
	Right Angle	TC-600-NMC-RA	3190-233	<1.35:1 (2.5)	Hex	Solder	Clamp	SG	2.1 (53)	0.92 (23.4)	0.280 (117.9)
	Right Angle	EZ-600-NMH-RA	3190-762	<1.35:1 (2.5)	Hex	Spring Finger	Crimp	SG	2.1 (53)	0.92 (23.4)	0.185 (83.9)
	Right Angle	TC-600-NMH-RA	3190-785	<1.35:1 (6)	Hex	Solder	Crimp	SG	2.1 (53)	0.92 (23.4)	0.185 (83.9)
N Female	Straight Jack	EZ-600-NF	3190-955	<1.25:1 (2.5)	NA	Spring Finger	Crimp	SG	2.3 (59)	0.87 (22.1)	0.150 (68.0)
	Bulkhead Jack	EZ-600-NF-BH	3190-616	<1.25:1 (2.5)	NA	Spring Finger	Crimp	SG	2.4 (61)	0.88 (22.4)	0.195 (88.5)
	Bulkhead Jack	TC-600-NF-BH	3190-589	<1.25:1 (2.5)	NA	Solder	Crimp	SG	2.4 (61)	0.88 (22.4)	0.195 (88.5)
	Bulkhead Jack	TC-600-NFC-BH	3190-466	<1.25:1 (2.5)	NA	Solder	Clamp	SG	2.2 (56)	0.94 (23.9)	0.214 (97.1)
TNC Male	Straight Plug	EZ-600-TM	3190-418	<1.25:1 (2.5)	Knurl	Spring Finger	Crimp	SG	1.7 (43)	0.59 (15.0)	0.112 (50.8)
	Reverse Polarity	EZ-600-TM-RP	3190-796	<1.25:1 (2.5)	Knurl	Spring Finger	Crimp	AG	2.2 (56)	0.87 (22.0)	0.112 (50.8)
TNC Female	Reverse Polarity	EZ-600-TF-RP	3190-797	<1.25:1 (2.5)	NA	Spring Finger	Crimp	AG	2.3 (58)	0.87 (22.0)	0.100 (45.4)
UHF Male	Straight Plug	EZ-600-UM	3190-615	<1.25:1 (2.5)	Knurl	Spring Finger	Crimp	SG	1.7 (43)	0.88 (22.4)	0.164 (74.4)
	Straight Plug	TC-600-UMC	3190-213	<1.25:1 (2.5)	Knurl	Solder	Clamp	SG	1.7 (43)	0.88 (22.4)	0.198 (89.8)
7-16 DIN Male	Straight Plug	EZ-600-716-MH	3190-503	<1.25:1 (2.5)	Hex	Spring Finger	Crimp	SS	2.0 (51)	1.30 (33.0)	0.254 (115.2)
	Straight Plug	TC-600-716-MC	3190-502	<1.25:1 (2.5)	Hex	Solder	Clamp	SS	2.0 (51)	1.30 (33.0)	0.347 (157.4)
	Right Angle	TC-600-716-MRA	3190-395	<1.35:1 (2.5)	Hex	Solder	Crimp	SS	1.4 (36)	1.40 (35.6)	0.354 (160.8)
7-16 DIN Female	Straight Jack	TC-600-716-FC	3190-375	<1.25:1 (2.5)	NA	Solder	Clamp	SS	1.1 (28)	1.00 (25.4)	0.249 (112.9)
7/8 EIA	Flange	TC-600-78EIA	3190-1373	<1.25:1 (2.5)	NA	Solder	Clamp	SS	2.3 (58)	2.60 (66.0)	0.873 (396.0)

* Finish metals: N=Nickel, S=Silver, G=Gold, SS=Stainless Steel, A=Albailloy **VSWR spec based on 3 foot cable with a connector pair



Install Tools

Type	Part Number	Stock Code	Description
Crimp Tool	HX-4	3190-200	Crimp Handle
Crimp Dies	Y1720	3190-203	.610" Hex Dies
Crimp Rings	CR-600	3190-831	Crimp Rings for TC/EZ-600 connectors (pkg of 10)
Strip Tool	ST-600C	3190-230	For Clamp Style Connectors
Strip Tool	ST-600EZ	3190-310	For Crimp Style Connectors
Deburr Tool	DBT-01	3190-406	Removes center conductor rough edges
Midspace Strip Tool	GST-600A	3190-1051	For ground strap attachment
Cutting Tool	CCT-01	3190-1544	Cable end flush cut tool
Replacement Blades	RB-01	3190-1609	Replacement blades for cutting tool
Tool Kit	TK-600EZ	3190-1602	Tool kit for LMR-600 Crimp Connectors (includes CCT-01, ST-600EZ, HX-4, Y1720, DBT-01, Tool Pouch)



Hardware Accessories

Type	Part Number	Stock Code	Description
Ground Kit	GK-S600T	GK-S600T	Standard Grounding Kit (each)
Hoisting Grip	HG-600T	HG-600T	Split/Laced Type (each)
Cold Shrink	CS-A600T	CS-A600T	Cable to Antenna Junction (each)
Cold Shrink	CS-60120T	CS-60120T	LMR-600 to -1200 Junction (each)
Cold Shrink	CS-60170T	CS-60170T	LMR-600 to -1700 Junction (each)
Hanger Blocks	CB-600T	CB-600T	Dual Cable Support Block (kit of 10)
Hanger Block Supporting Hardware			Complete Range of Supporting Hardware & Adapters Available
Snap-In Hangers	SH-U600T	SH-U600T	Snap-In Hangers (Kit of 10)

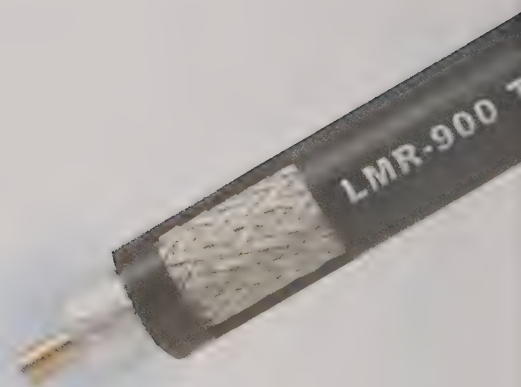
TIMES MICROWAVE SYSTEMS

A Smiths Group plc company

LMR-900 Flexible Low Loss Communications Coax

Ideal for...

- Medium Antenna Feeder runs (no jumpers required)
- Jumper Assemblies for 1-5/8" & 2-1/4" Feeders
- Any application (e.g. WLL, LMR, Paging, PCS, Cellular) requiring an easily routed, low loss RF cable



• **LMR® - DB** is identical to standard LMR plus has the advantage of being watertight. The addition of waterproofing compound in and around the foil/braid insures continuous reliable service should the jacket be inadvertently damaged during installation or in the future.

• **LMR® - FR** is a non-halogen (non-toxic), low smoke, fire retardant cable designed for in-building runs that can be routed anywhere except air handling plenums. LMR-FR has a UL/NEC & CSA rating of 'CMR/MPR' and 'FT4' respectively.

• **Flexibility** and bendability are hallmarks of the LMR-900 cable design. The flexible outer conductor enables the tightest bend radius available for any cable of similar size and performance.

• **Low Loss** is another hallmark feature of LMR-900. Size for size LMR has the lowest loss of any flexible cable and comparable loss to semirigid hard-line cables.

• **RF Shielding** is 50 dB greater than typical single shielded coax (40 dB). The multi-ply bonded foil outer conductor is rated conservatively at > 90 dB (i.e. >180 dB between two adjacent cables).

• **Weatherability:** LMR-900 cables designed for outdoor exposure incorporate the best materials for UV resistance and have life expectancy in excess of 20 years.

• **Connectors:** A selection of connectors including type-N, 7/16 DIN, and 7/8 EIA flanges are available for LMR-900. Other interfaces are available on request. Transition to interfaces smaller than type-N is best accomplished with a short jumper cable.

• **Cable Assemblies:** All LMR-900 cable types are available as pre-terminated cable assemblies. Refer to the section on FlexTech for further details.

Part Description				
Part N.	Application	Jacket	Color	Stock Code
LMR-900-DB	Outdoor/Watertight	PE	Black	54094
LMR-900-FR	Indoor -Riser CMR	FRPE	Black	54033

Construction Specifications			
Description	Material	In.	(mm)
Inner Conductor	BC Tube	0.262	(6.65)
Dielectric	Foam PE	0.680	(17.27)
Outer Conductor	Aluminum Tape	0.686	(17.42)
Overall Braid	Tinned Copper	0.732	(18.59)
Jacket	(see table above)	0.870	(22.10)

Mechanical Specifications

Performance Property	Units	US	(metric)
Bend Radius: installation	in. (mm)	3.00	(76.2)
Bend Radius: repeated	in. (mm)	9.0	(228.6)
Bending Moment	ft-lb (N-m)	9.0	(12.20)
Weight	lb/ft (kg/m)	0.266	(0.40)
Tensile Strength	lb (kg)	750	(340.5)
Flat Plate Crush	lb/in. (kg/mm)	100	(1.79)

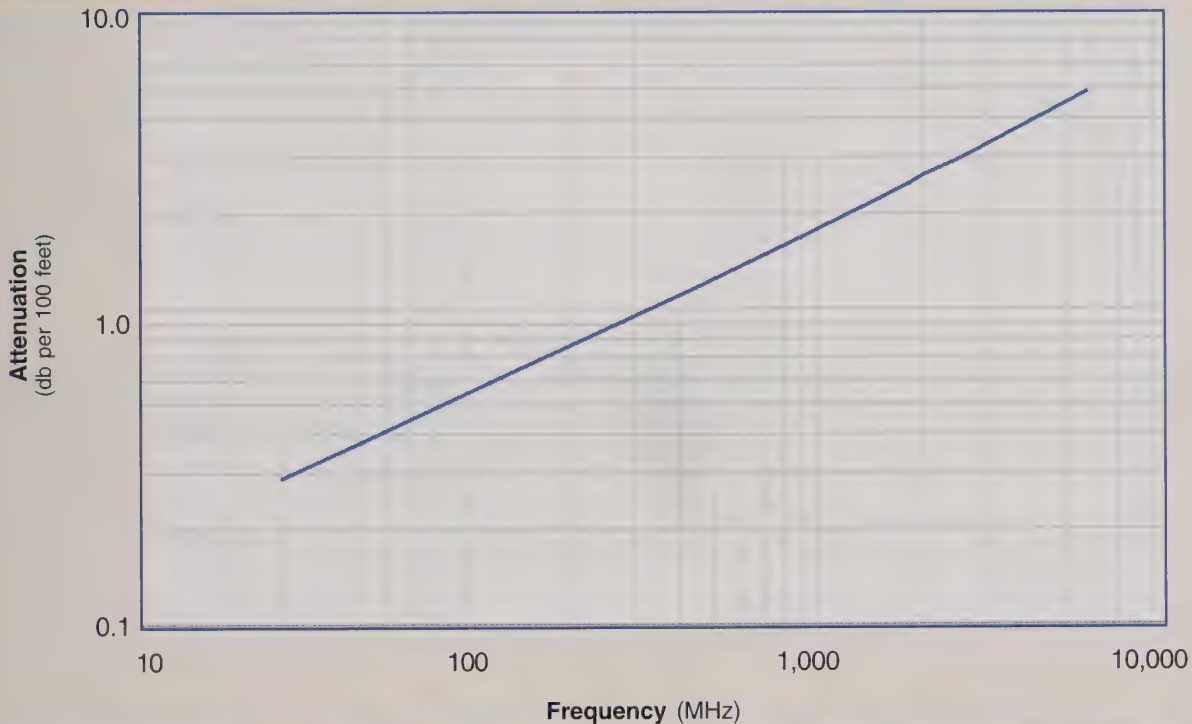
Environmental Specifications

Performance Property	°F	°C
Installation Temperature Range	-40/+185	-40/+85
Storage Temperature Range	-94/+185	-70/+185
Operating Temperature Range	-40/+185	-40/+85

Electrical Specifications

Performance Property	Units	US	(metric)
Cutoff Frequency	GHz	6.9	
Velocity of Propagation	%	87	
Dielectric Constant	NA	1.32	
Time Delay	nS/ft (nS/m)	1.17	(3.83)
Impedance	ohms	50	
Capacitance	pF/ft (pF/m)	23.4	(76.6)
Inductance	uH/ft (uH/m)	0.058	(0.19)
Shielding Effectiveness	dB	>90	
DC Resistance			
Inner Conductor	ohms/1000ft (/km)	0.54	(1.8)
Outer Conductor	ohms/1000ft (/km)	0.55	(1.8)
Voltage Withstand	Volts DC	5000	
Jacket Spark	Volts RMS	8000	
Peak Power	kW	62	

Attenuation vs. Frequency (typical)



Frequency (MHz)	30	50	150	220	450	900	1500	1800	2000	2500	5800
Attenuation dB/100 ft	0.3	0.4	0.7	0.8	1.2	1.7	2.2	2.5	2.6	3.0	4.9
Attenuation dB/100 m	0.9	1.2	2.2	2.6	3.8	5.6	7.4	8.2	8.6	9.8	16.0
Avg. Power kW	8.89	6.85	3.89	3.19	2.19	1.51	1.14	1.03	0.97	0.86	0.52

Calculate Attenuation =

$(0.051770) \cdot \sqrt{\text{FMHz}} + (0.000160) \cdot \text{FMHz}$ (interactive calculator available at <http://www.timesmicrowave/telecom>)

Attenuation:

VSWR=1.0 ; Ambient = +25°C (77°F)

Power:

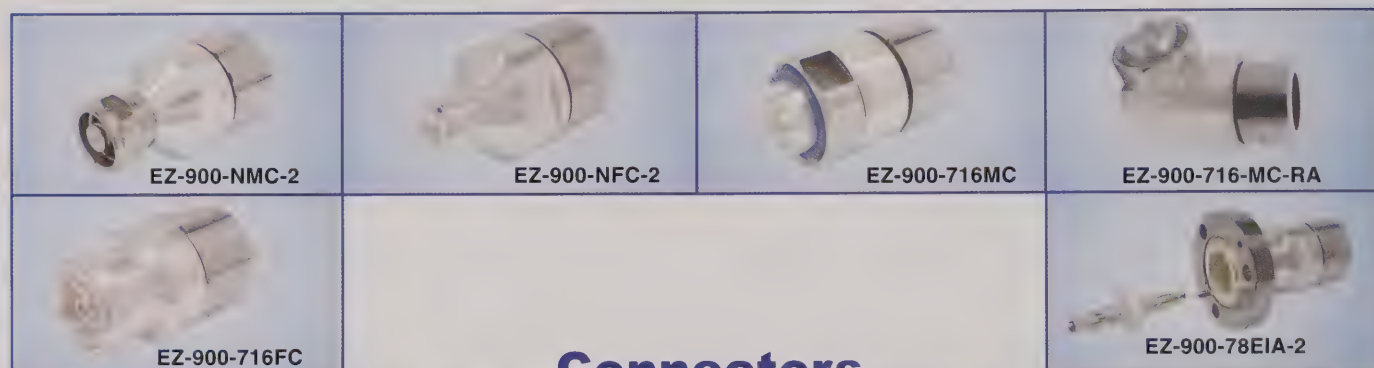
VSWR=1.0; Ambient = +40°C; Inner Conductor = 100°C (212°F); Sea Level; dry air; atmospheric pressure; no solar loading

TIMES MICROWAVE SYSTEMS

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LMR-900

Flexible Low Loss Communications Coax



Connectors

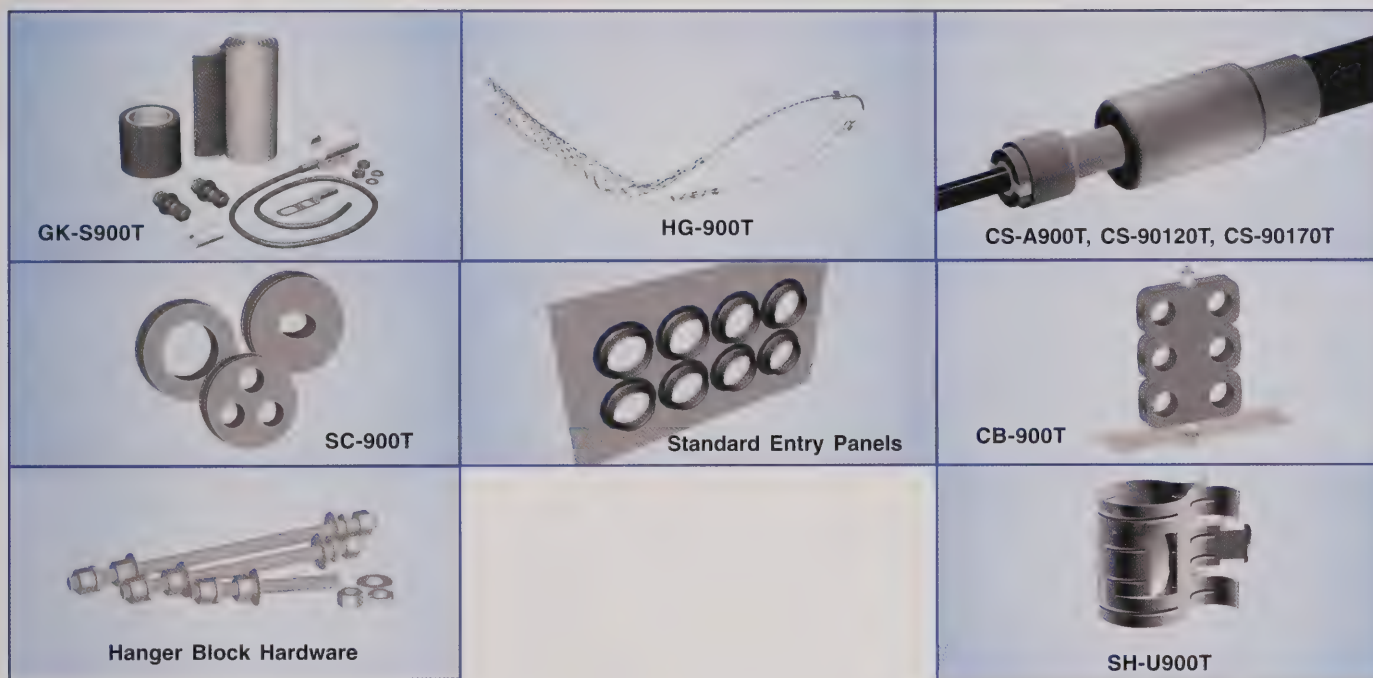
Interface	Description	Part Number	Stock Code	VSWR** Freq. (GHz)	Coupling Nut	Inner Contact Attach	Outer Contact Attach	Finish* Body /Pin	Length in (mm)	Width in (mm)	Weight lb (g)
N Male	Straight Plug	EZ-900-NMC-2	3190-1262	<1.25:1 (6)	Hex	Press Fit	Clamp	S/S	2.0 (51)	1.38 (35.1)	0.463 (210.0)
N Female	Straight Jack	EZ-900-NFC-2	3190-1263	<1.25:1 (6)	NA	Press Fit	Clamp	SS	2.0 (51)	1.38 (35.1)	0.443 (200.9)
7-16 DIN Male	Straight Plug	EZ-900-716MC	3190-333	<1.25:1 (25)	Hex	Press Fit	Clamp	SS	2.0 (51)	1.44 (36.6)	0.485 (220.0)
7-16 DIN Male	Right Angle	EZ-900-716-MC-RA	3190-614	<1.35:1 (25)	Hex	Press Fit	Clamp	SS	2.7 (69)	2.15 (55.0)	1.150 (521.6)
7-16 DIN Female	Straight Jack	EZ-900-716FC	3190-334	<1.25:1 (25)	NA	Press Fit	Clamp	SS	2.0 (51)	1.38 (35.1)	0.379 (171.9)
7/8 EIA	Straight Plug	EZ-900-78EIA-2	3190-1282	<1.25:1 (25)	NA	Press Fit	Clamp	SS	3.0 (76)	2.24 (56.9)	1.013 (459.5)

* Finish metals: N=Nickel, S=Silver, G=Gold, SS=Stainless Steel, A=Alballoy **VSWR spec based on 3 foot cable with a connector pair



Install Tools

Type	Part Number	Stock Code	Description
Strip Tool	ST-900/1200C	3190-311	For LMR 900 & 1200 Clamp Style Connectors
Strip Tool	ST-900C	3190-1310	For LMR 900 Clamp Style Connectors
Midspan Strip Tool	GST-900A	3190-435	For Ground Strap Attachment
Wrenches	WR-900	3190-510	1-1/4" Box Wrench (2 required)
Cutting Tool	CCT-01	3190-1544	Cable end flush cut tool
Replacement Blades	RB-01	3190-1609	Replacement blades for cutting tool



Accessories

Type	Part Number	Stock Code	Description
Ground Kit	GK-S900T	GK-S900T	Standard Grounding Kit (each)
Hoisting Grip	HG-900T	HG-900T	Split/Laced Type (each)
Cold Shrink	CS-A900T	CS-A900T	Cable to Antenna Junction (each)
Cold Shrink	CS-90120T	CS-90120T	LMR-900 to -1200 Junction (each)
Cold Shrink	CS-90170T	CS-90170T	LMR-900 to -1700 Junction (each)
Stand. Entry Port Cushion	SC-900T	SC-900T	Three Cables (each)
Standard Entry Panels			Full Range of Port Styles/Combinations Available
Hanger Blocks	CB-900T	CB-900T	Dual Cable Support Block (kit of 10)
Hanger Block Supporting Hardware			Complete Range of Supporting Hardware & Adapters Available
Snap-in Hangers	SH-U900T	SH-U900T	Snap-in Hanger (Kit of 10)

TIMES MICROWAVE SYSTEMS

A Smiths Group plc company

LMR-1200

Flexible Low Loss Communications Coax

Ideal for...

- Medium Antenna Feeder runs
- Jumper Assemblies for 1-5/8" & 2-1/4" Feeders
- Building-Top Sites
- Any application (e.g. WLL, LMR, Paging, PCS, Cellular) requiring an easily routed, low loss RF cable



• **LMR® - DB** is identical to standard LMR plus has the advantage of being watertight. The addition of waterproofing compound in and around the foil/braid insures continuous reliable service should the jacket be inadvertently damaged during installation or in the future.

• **LMR® - FR** is a non-halogen (non-toxic), low smoke, fire retardant cable designed for in-building runs that can be routed anywhere except air handling plenums. LMR-FR has a UL/NEC & CSA rating of 'CMR/MPR' and 'FT4' respectively.

• **Flexibility** and bendability are hallmarks of the LMR-1200 cable design. The flexible outer conductor enables the tightest bend radius available for any cable of similar size and performance.

• **Low Loss** is another hallmark feature of LMR-1200. Size for size LMR has the lowest loss of any flexible cable and comparable loss to semirigid hard-line cables.

• **RF Shielding** is 50 dB greater than typical single shielded coax (40 dB). The multi-ply bonded foil outer conductor is rated conservatively at > 90 dB (i.e. >180 dB between two adjacent cables).

• **Weatherability:** LMR-1200 cables designed for outdoor exposure incorporate the best materials for UV resistance and have life expectancy in excess of 20 years.

• **Connectors:** A selection of connectors including type-N, 7/16 DIN, and 7/8 EIA flanges are available for LMR-1200. Other interfaces are available on request. Transition to interfaces smaller than type-N is best accomplished with a short jumper cable.

• **Cable Assemblies:** All LMR-1200 cable types are available as pre-terminated cable assemblies. Refer to the section on FlexTech for further details.

Part Description

Part No.	Application	Jacket	Color	Stock Code
LMR-1200-DB	Outdoor/Watertight	PE	Black	54095
LMR-1200-FR	Indoor -Riser CMR	FRPE	Black	54034

Construction Specifications

Description	Material	In.	(mm)
Inner Conductor	BC Tube	0.349	(8.86)
Dielectric	Foam PE	0.920	(23.37)
Outer Conductor	Aluminum Tape	0.926	(23.52)
Overall Braid	Tinned Copper	0.972	(24.69)
Jacket	(see table above)	1.200	(30.48)

Mechanical Specifications

Performance Property	Units	US	(metric)
Bend Radius: installation	in. (mm)	6.50	(165.1)
Bend Radius: repeated	in. (mm)	12.0	(304.8)
Bending Moment	ft-lb (N-m)	15	(20.34)
Weight	lb/ft (kg/m)	0.448	(0.67)
Tensile Strength	lb (kg)	1300	(590.2)
Flat Plate Crush	lb/in. (kg/mm)	250	(4.47)

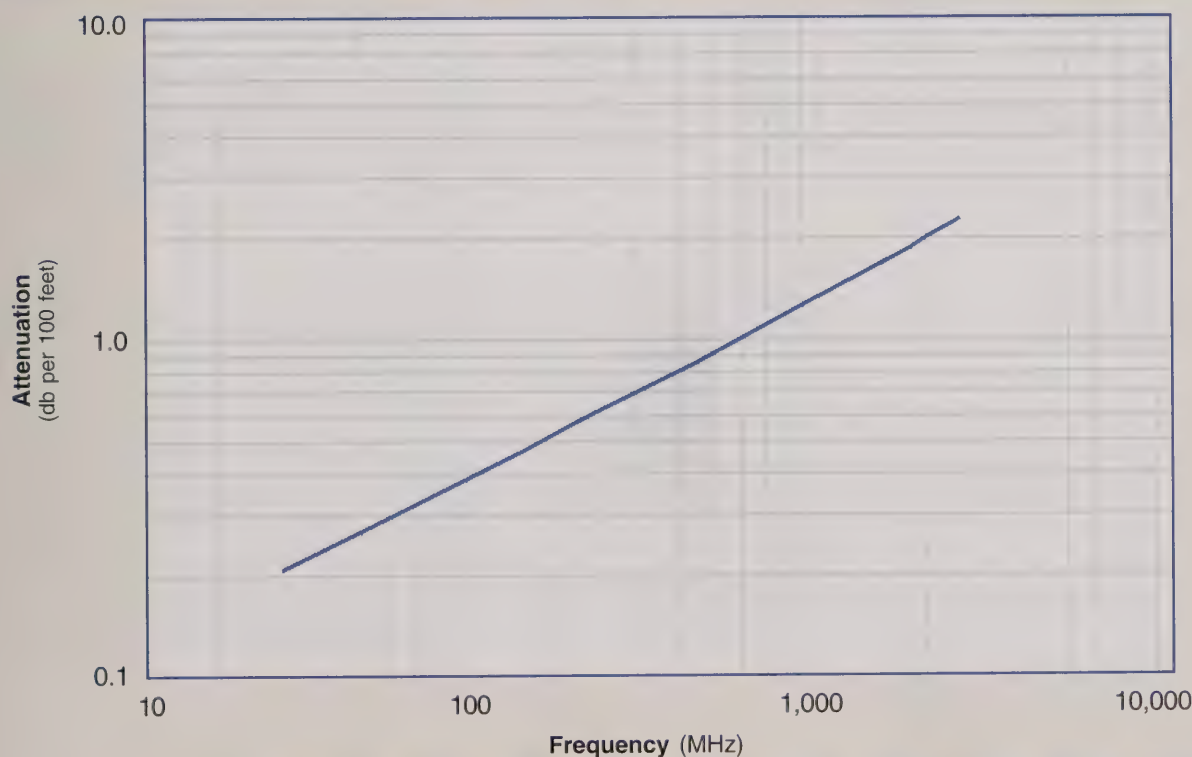
Environmental Specifications

Performance Property	°F	°C
Installation Temperature Range	-40/+185	-40/+85
Storage Temperature Range	-94/+185	-70/+185
Operating Temperature Range	-40/+185	-40/+85

Electrical Specifications

Performance Property	Units	US	(metric)
Cutoff Frequency	GHz	5.2	
Velocity of Propagation	%	88	
Dielectric Constant	NA	1.29	
Time Delay	nS/ft (nS/m)	1.15	(3.79)
Impedance	ohms	50	
Capacitance	pF/ft (pF/m)	23.1	(75.8)
Inductance	uH/ft (uH/m)	0.058	(0.19)
Shielding Effectiveness	dB	>90	
DC Resistance			
Inner Conductor	ohms/1000ft (/km)	0.32	(1.0)
Outer Conductor	ohms/1000ft (/km)	0.37	(1.2)
Voltage Withstand	Volts DC	6000	
Jacket Spark	Volts RMS	8000	
Peak Power	kW	90	

Attenuation vs. Frequency (typical)



Frequency (MHz)	30	50	150	220	450	900	1500	1800	2000	2500
Attenuation dB/100 ft	0.2	0.3	0.5	0.6	0.9	1.3	1.7	1.9	2.0	2.3
Attenuation dB/100 m	0.7	0.9	1.6	1.9	2.8	4.2	5.5	6.1	6.5	7.4
Avg. Power kW	12.63	9.72	5.54	4.49	3.06	2.09	1.57	1.41	1.33	1.16

Calculate Attenuation =

$(0.037370) \cdot \sqrt{\text{FMHz}} + (0.000160) \cdot \text{FMHz}$ (interactive calculator available at <http://www.timesmicrowave/telecom>)

Attenuation:

VSWR=1.0 ; Ambient = +25°C (77°F)

Power:

VSWR=1.0; Ambient = +40°C; Inner Conductor = 100°C (212°F); Sea Level; dry air; atmospheric pressure; no solar loading

TIMES MICROWAVE SYSTEMS

A Smiths Group plc company

LMR-1200

Flexible Low Loss Communications Coax



EZ-1200-NMC



EZ-1200-NFC



EZ-1200-716MC



EZ-1200-716-FC



EZ-1200-78EIA

Connectors

Interface	Description	Part Number	Stock Code	VSWR** Freq. (GHz)	Coupling Nut	Inner Contact Attach	Outer Contact Attach	Finish* Body /Pin	Length in (mm)	Width in (mm)	Weight lb (g)
N Male	Straight Plug	EZ-1200-NMC	3190-335	<1.25:1 (2.5)	Hex	Press Fit	Clamp	S/S	2.0 (51)	1.65 (41.9)	0.659 (298.9)
N Female	Straight Jack	EZ-1200-NFC	3190-336	<1.25:1 (2.5)	NA	Press Fit	Clamp	S/S	2.0 (51)	1.65 (41.9)	0.650 (294.8)
7-16 DIN Male	Straight Plug	EZ-1200-716MC	3190-337	<1.25:1 (2.5)	Hex	Press Fit	Clamp	S/S	2.0 (51)	1.65 (41.9)	0.648 (293.9)
7-16 DIN Female	Straight Jack	EZ-1200-716FC	3190-338	<1.25:1 (2.5)	NA	Press Fit	Clamp	S/S	2.0 (51)	1.65 (41.9)	0.586 (265.8)
7/8 EIA	Straight Plug	EZ-1200-78EIA	3190-323	<1.25:1 (2.5)	NA	Press Fit	Clamp	S/S	3.2 (80)	2.25 (57.2)	1.208 (547.0)

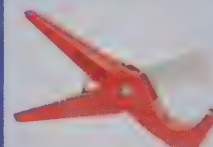
* Finishes: N=Nickel, S=Silver, G=Gold, SS=Stainless Steel, A=Alballoy **VSWR spec based on 3 foot cable with a connector pair



ST-900/1200C



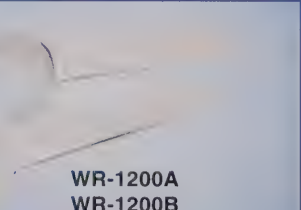
ST-1200C



CCT-01



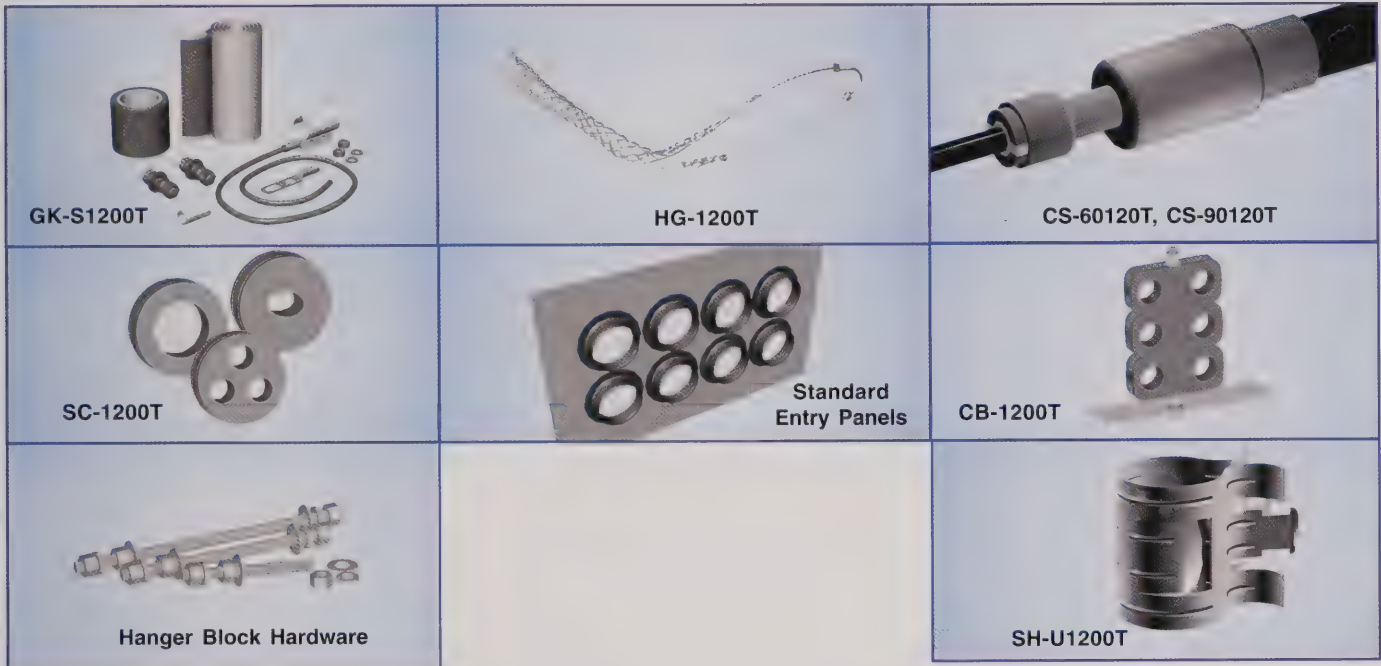
GST-1200A



WR-1200A
WR-1200B

Install Tools

Type	Part Number	Stock Code	Description
Strip Tool	ST-900/1200C	3190-311	For LMR 900 & 1200 Clamp Style Connectors
Strip Tool	ST-1200C	3190-1311	For LMR 1200 Clamp Style Connectors
Midspan Strip Tool	GST-1200A	3190-436	For Ground Strap Attachment
Wrench	WR-1200A	3190-512	1-9/16" Box Wrench (1 required)
Wrench	WR-1200B	3190-511	1-7/16" Box Wrench Pair (1 required)
Cutting Tool	CCT-01	3190-1544	Cable end flush cut tool
Replacement Blades	RB-01	3190-1609	Replacement blades for cutting tool



Hardware Accessories

Type	Part Number	Stock Code	Description
Ground Kit	GK-S1200T	GK-S1200T	Standard Grounding Kit (each)
Hoisting Grip	HG-1200T	HG-1200T	Split/Laced Type (each)
Cold Shrink	CS-90120T	CS-90120T	LMR-900 to -1200 Junction (each)
Cold Shrink	CS-60120T	CS-60120T	LMR-600 to -1200 Junction (each)
Standard Entry Port Cushion	SC-1200T	SC-1200T	Three Cables (each)
Standard Entry Panels	Full Range of Port Styles/Combinations Available		
Hanger Blocks	CB-1200T	CB-1200T	Dual Cable Support Block (kit of 10)
Hanger Block Supporting Hardware	Complete Range of Supporting Hardware & Adapters Available		
Snap-In Hangers	SH-U1200T	SH-U1200T	Snap-In Hangers (Kit of 10)

TIMES MICROWAVE SYSTEMS

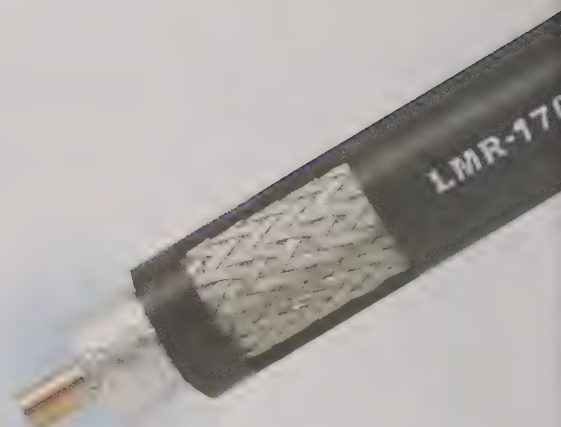
A Smiths Group plc company

LMR-1700

Flexible Low Loss Communications Coax

Ideal for...

- Long Antenna Feeder runs
- Building-Top Sites
- Any application (e.g. WLL, LMR, Paging, PCS, Cellular) requiring an easily routed, low loss RF cable



• **LMR® - DB** is identical to standard LMR plus has the advantage of being watertight. The addition of waterproofing compound in and around the foil/braid insures continuous reliable service should the jacket be inadvertently damaged during installation or in the future.

• **LMR® - FR** is a non-halogen (non-toxic), low smoke, fire retardant cable designed for in-building runs that can be routed anywhere except air handling plenums. LMR-FR has a UL/NEC & CSA rating of 'CMR/MPR' and 'FT4' respectively.

• **Flexibility** and bendability are hallmarks of the LMR-1700 cable design. The flexible outer conductor enables the tightest bend radius available for any cable of similar size and performance.

• **Low Loss** is another hallmark feature of LMR-1700. Size for size LMR has the lowest loss of any flexible cable and comparable loss to semirigid hard-line cables.

• **RF Shielding** is 50 dB greater than typical single shielded coax (40 dB). The multi-ply bonded foil outer conductor is rated conservatively at > 90 dB (i.e. >180 dB between two adjacent cables).

• **Weatherability:** LMR-1700 cables designed for outdoor exposure incorporate the best materials for UV resistance and have life expectancy in excess of 20 years.

• **Connectors:** A selection of connectors including type-N, 7/16 DIN, and 7/8 EIA flanges are available for LMR-1700. Other interfaces are available on request. Transition to interfaces smaller than type-N is best accomplished with a short jumper cable.

• **Cable Assemblies:** All LMR-1700 cable types are available as pre-terminated cable assemblies. Refer to the section on FlexTech for further details.

Part Description

Part No.	Application	Jacket	Color	Stock Code
LMR-1700-DB	Outdoor/Watertight	PE	Black	54096
LMR-1700-FR	Indoor -Riser CMR	FRPE	Black	54035

Construction Specifications

Description	Material	In.	(mm)
Inner Conductor	BC Tube	0.527	(13.39)
Dielectric	Foam PE	1.350	(34.29)
Outer Conductor	Aluminum Tape	1.356	(34.44)
Overall Braid	Tinned Copper	1.402	(35.61)
Jacket	(see table above)	1.670	(42.42)

Mechanical Specifications

Performance Property	Units	US	(metric)
Bend Radius: installation	in. (mm)	13.50	(342.9)
Bend Radius: repeated	in. (mm)	17.0	(431.8)
Bending Moment	ft-lb (N-m)	40	(54.23)
Weight	lb/ft (kg/m)	0.736	(1.10)
Tensile Strength	lb (kg)	1500	(681.0)
Flat Plate Crush	lb/in. (kg/mm)	300	(5.36)

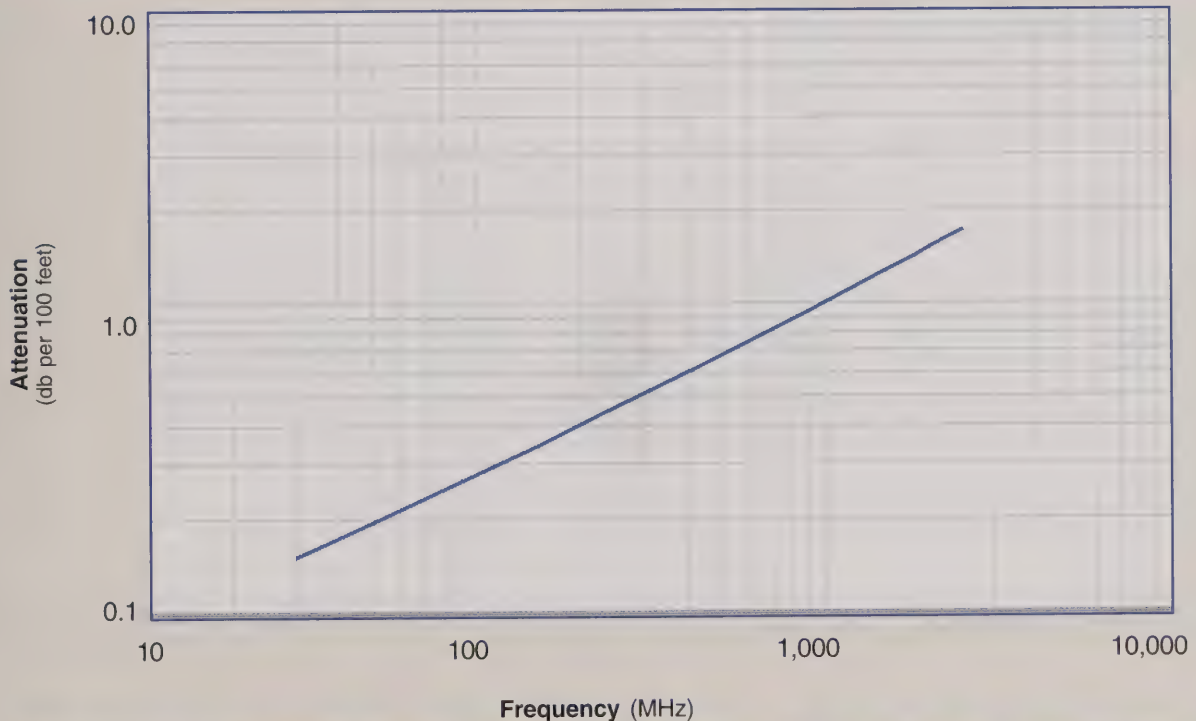
Environmental Specifications

Performance Property	°F	°C
Installation Temperature Range	-40/+185	-40/+85
Storage Temperature Range	-94/+185	-70/+185
Operating Temperature Range	-40/+185	-40/+85

Electrical Specifications

Performance Property	Units	US	(metric)
Cutoff Frequency	GHz		3.6
Velocity of Propagation	%		89
Dielectric Constant	NA		1.26
Time Delay	nS/ft (nS/m)	1.14	(3.75)
Impedance	ohms		50
Capacitance	pF/ft (pF/m)	22.8	(74.9)
Inductance	uH/ft (uH/m)	0.057	(0.19)
Shielding Effectiveness	dB		>90
DC Resistance			
Inner Conductor	ohms/1000ft (/km)	0.21	(0.7)
Outer Conductor	ohms/1000ft (/km)	0.27	(0.9)
Voltage Withstand	Volts DC		9000
Jacket Spark	Volts RMS		8000
Peak Power	kW		202

Attenuation vs. Frequency (typical)



Frequency (MHz)	30	50	150	220	450	900	1500	1800	2000	2500
Attenuation dB/100 ft	0.1	0.2	0.3	0.4	0.6	0.9	1.3	1.4	1.5	1.7
Attenuation dB/100 m	0.5	0.6	1.1	1.4	2.1	3.1	4.1	4.6	4.9	5.7
Avg. Power kW	20.27	15.55	8.72	7.09	4.79	3.23	2.40	2.15	2.02	1.76

Calculate Attenuation =

$(0.026460) \cdot \sqrt{\text{FMHz}} + (0.000160) \cdot \text{FMHz}$ (interactive calculator available at <http://www.timesmicrowave/telecom>)

Attenuation:

VSWR=1.0; Ambient = +25°C (77°F)

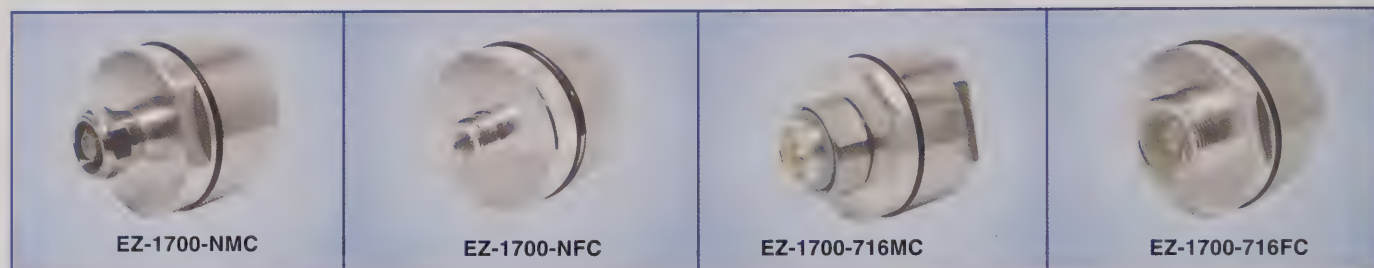
Power:

VSWR=1.0; Ambient = +40°C; Inner Conductor = 100°C (212°F); Sea Level; dry air; atmospheric pressure; no solar loading

TIMES MICROWAVE SYSTEMS

A Smiths Group plc company

LMR-1700 Flexible Low Loss Communications Coax



Connectors

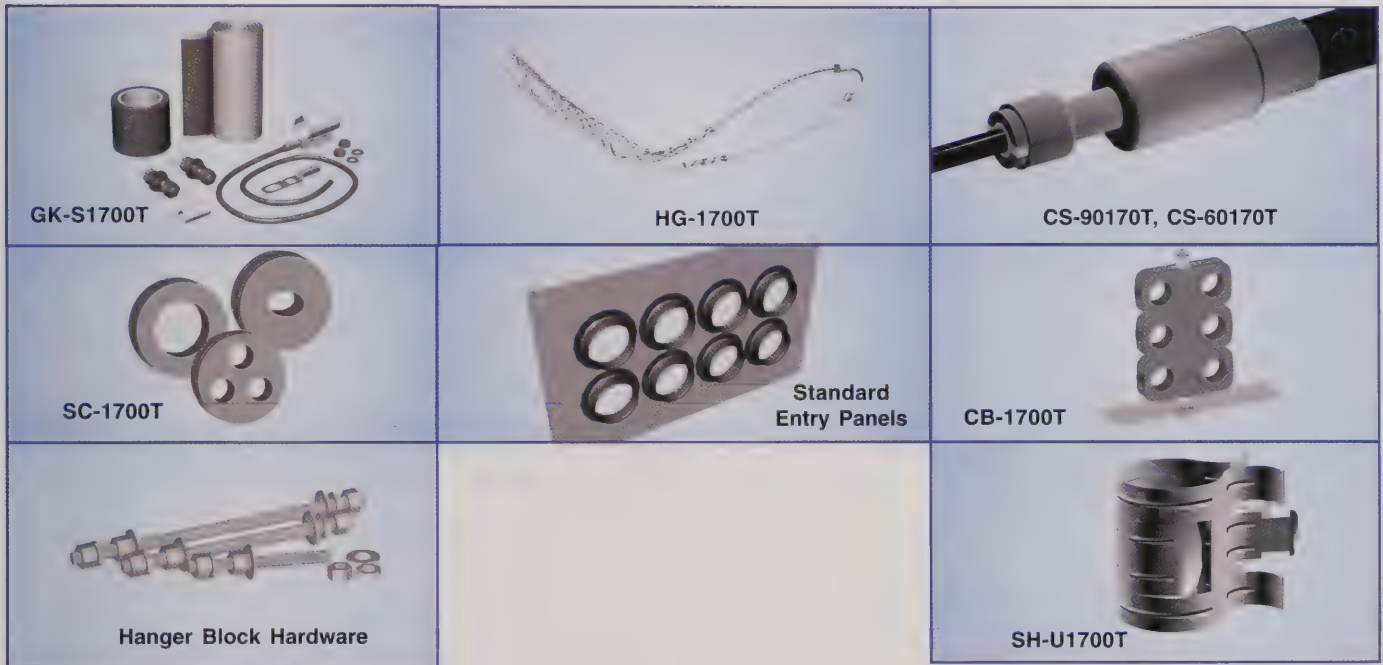
Interface	Description	Part Number	Stock Code	VSWR** Freq. (GHz)	Coupling Nut	Inner Contact Attach	Outer Contact Attach	Finish* Body /Pin	Length in (mm)	Width in (mm)	Weight lb (g)
N Male	Straight Plug	EZ-1700-NMC	3190-385	<1.25:1 (2.5)	Hex	Press Fit	Clamp	S/S	2.17 (55)	2.2 (55.9)	1.058 (479.9)
N Female	Straight Jack	EZ-1700-NFC	3190-386	<1.25:1 (2.5)	NA	Press Fit	Clamp	S/S	2.17 (55)	2.2 (55.9)	1.087 (493.1)
7-16 DIN Male	Straight Plug	EZ-1700-716MC	3190-387	<1.25:1 (2.5)	Hex	Press Fit	Clamp	S/S	2.17 (55)	2.2 (55.9)	1.055 (478.5)
7-16 DIN Female	Straight Jack	EZ-1700-716FC	3190-388	<1.25:1 (2.5)	NA	Press Fit	Clamp	S/S	2.17 (55)	2.2 (55.9)	1.005 (455.9)

* Finishes: N=Nickel, S=Silver, G=Gold, SS=Stainless Steel, A=Alballoy **VSWR spec based on 3 foot cable with a connector pair



Install Tools

Type	Part Number	Stock Code	Description
Strip Tool	ST-1700C	3190-312	For Clamp Style Connectors
Midspan Strip Tool	GST-1700A	3190-437	For Ground Strap Attachment
Wrenches	WR-1700	3190-514	2" Box Wrench (2 required)
Cutting Tool	CCT-01	3190-1544	Cable end flush cut tool
Replacement Blades	RB-01	3190-1609	Replacement blades for cutting tool



Hardware Accessories

Type	Part Number	Stock Code	Description
Ground Kit	GK-S1700T	GK-S1700T	Standard Grounding Kit (each)
Hoisting Grip	HG-1700T	HG-1700T	Split/Laced Type (each)
Cold Shrink	CS-90170T	CS-90170T	LMR-900 to -1700 Junction (each)
Cold Shrink	CS-60170T	CS-60170T	LMR-600 to -1700 Junction (each)
Standard Entry Port Cushion	SC-1700T	SC-1700T	One Cable (each)
Standard Entry Panels	Full Range of Port Styles/Combinations Available		
Hanger Blocks	CB-1700T	CB-1700T	Dual Cable Support Block (kit of 10)
Hanger Block Supporting Hardware	Complete Range of Supporting Hardware & Adapters Available		
Snap-In Hangers	SH-U1700T	SH-U1700T	Snap-In Hangers (Kit of 10)

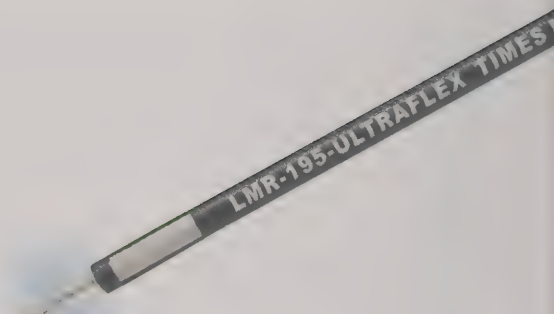
TIMES MICROWAVE SYSTEMS

A Smiths Group plc company

LMR-195-UF UltraFlex Communications Coax

Ideal for...

- Jumper Assemblies in Wireless Communications Systems
- Short Antenna Feeder runs
- Any application that requires periodic/repeated flexing



• **LMR® - UltraFlex** has a stranded center conductor and rubber outer jacket designed for multiple bending/flexing cycles. It is used for both indoor and outdoor applications.

• **Flexibility** and bendability are hallmarks of the LMR-195-UF cable design. The flexible outer conductor enables the tightest bend radius available for any cable of similar size and performance.

• **Low Loss** is another hallmark feature of LMR. Size for size LMR has the lowest loss of any flexible cable and comparable loss to semirigid hard-line cables.

• **RF Shielding** is 50 dB greater than typical single shielded coax (40 dB). The multi-ply bonded foil outer conductor is rated conservatively at > 90 dB (i.e. >180 dB between two adjacent cables).

• **Weatherability:** LMR-195-UF cables are designed for outdoor exposure and have a life expectancy in excess of 10 years.

• **Connectors:** A wide variety of connectors are available for LMR cable, including all common interface types, reverse polarity, and solder-on center pins. Most LMR connectors employ crimp outer attachment using standard hex crimp sizes.

• **Cable Assemblies:** All LMR-195-UF cable types are available as pre-terminated cable assemblies. Refer to the section on FlexTech for further details.

Construction Specifications			
Description	Material	In.	(mm)
Inner Conductor	Stranded BC	0.038	(0.97)
Dielectric	Foam Polyethylene	0.110	(2.79)
Outer Conductor	Aluminum Tape	0.116	(2.95)
Overall Braid	Tinned Copper	0.139	(3.53)
Jacket	Black Thermoplastic Elastomer	0.195	(4.95)

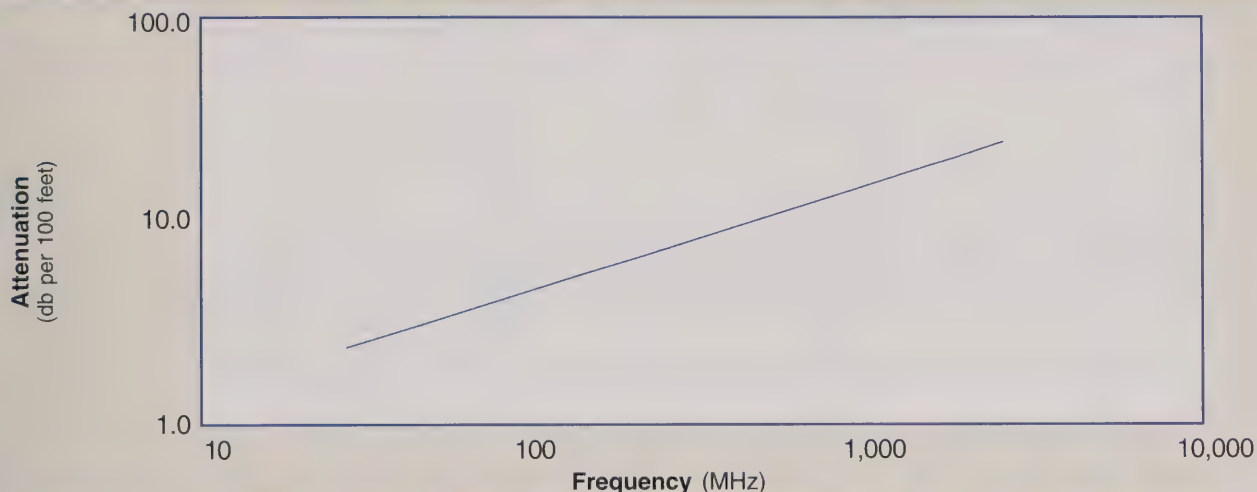
Mechanical Specifications			
Performance Property	Units	US	(metric)
Bend Radius: installation	in. (mm)	0.5	(12.7)
Bend Radius: repeated	in. (mm)	2	(50.8)
Bending Moment	ft-lb (N-m)	0.01	(0.14)
Weight	lb/ft (kg/m)	0.021	(0.03)
Tensile Strength	lb (kg)	40	(18.2)
Flat Plate Crush	lb/in. (kg/mm)	10	(0.18)

Environmental Specifications			
Performance Property	°F	°C	
Installation Temperature Range	-40/+185	-40/+85	
Storage Temperature Range	-94/+185	-70/+85	
Operating Temperature Range	-40/+185	-40/+85	

Electrical Specifications			
Performance Property	Units	US	(metric)
Cutoff Frequency	GHz	41	
Velocity of Propagation	%	80	
Dielectric Constant	NA	1.56	
Time Delay	nS/ft (nS/m)	1.27	(4.17)
Impedance	ohms	50	
Capacitance	pF/ft (pF/m)	16.9	(55.4)
Inductance	uH/ft (uH/m)	0.095	(0.31)
Shielding Effectiveness	dB	>90	
DC Resistance			
Inner Conductor	ohms/1000ft (/km)	9.5	(31.2)
Outer Conductor	ohms/1000ft (/km)	4.9	(16.1)
Voltage Withstand	Volts DC	1000	
Jacket Spark	Volts RMS	3000	
Peak Power	kW	2.5	

Part Description				
Part No.	Application	Jacket	Color	Stock Code
LMR-195-UF	Indoor/Outdoor	TPE	Black	54212

Attenuation vs. Frequency (typical)



Frequency (MHz)	30	50	150	220	450	900	1500	1800	2000	2500	5800
Attenuation dB/100 ft	2.3	3.0	5.3	6.4	9.3	13.2	17.3	19.0	20.1	22.6	35.6
Attenuation dB/100 m	7.7	9.9	17.3	21.1	30.4	43.4	56.7	62.4	65.9	74.2	116.7
Avg. Power kW	0.78	0.61	0.35	0.28	0.20	0.14	0.10	0.09	0.09	0.08	0.05

Calculate Attenuation = $(0.424232) \cdot \sqrt{\text{FMHz}} + (0.000563) \cdot \text{FMHz}$ (interactive calculator available at <http://www.timesmicrowave/telecom>)
 Attenuation: VSWR=1.0; Ambient = +25°C (77°F) Power: VSWR=1.0; Ambient = +40°C; Inner Conductor = 100°C (212°F);
 Sea Level; dry air; atmospheric pressure; no solar loading



Connectors

Interface	Description	Part Number	Stock Code	VSWR** Freq. (GHz)	Coupling Nut	Inner Contact Attach	Outer Contact Attach	Finish* Body /Pin	Length in (mm)	Width in (mm)	Weight lbs (g)
N male	Straight Plug	TC-195-NM	3190-1555	<1.25:1 (2.5)	Knurl	Solder	Crimp	S/G	1.5 (38.1)	0.75 (19.1)	0.073 (33.1)
SMA male	Straight Plug	TC-195-SM	3190-1553	<1.25:1 (2.5)	Hex	Solder	Crimp	SS/G	1.0 (25.4)	0.32 (8.1)	0.015 (6.8)
TNC male	Straight Plug	TC-195-TM	3190-1554	<1.25:1 (2.5)	Knurl	Solder	Crimp	S/G	1.4 (35.6)	0.59 (15.0)	0.045 (20.4)

* Finish metals: N=Nickel, S=Silver, G=Gold, SS=Stainless Steel, A=Alballoy **VSWR spec based on 3 foot cable with a connector pair



Install Tools



Type	Part Number	Stock Code	Description
Crimp Tool	CT-240/200/195/100	3190-667	Crimp tool for LMR 195 connectors
Cutting Tool	CCT-01	3190-1544	Cable end flush cut tool
Replacement Blades	RB-01	3190-1609	Replacement blades for cutting tool

TIMES MICROWAVE SYSTEMS

A Smiths Group plc company

LMR-200-UF UltraFlex Communications Coax

Ideal for...

- Jumper Assemblies in Wireless Communications Systems
- Short Antenna Feeder runs
- Any application that requires periodic/repeated flexing



• **LMR® - UltraFlex** has a stranded center conductor and rubber outer jacket designed for multiple bending/flexing cycles. It is used for both indoor and outdoor applications.

• **Flexibility** and bendability are hallmarks of the LMR-200-UF cable design. The flexible outer conductor enables the tightest bend radius available for any cable of similar size and performance.

• **Low Loss** is another hallmark feature of LMR-200-UF. Size for size LMR has the lowest loss of any flexible cable and comparable loss to semirigid hard-line cables.

• **RF Shielding** is 50 dB greater than typical single shielded coax (40 dB). The multi-ply bonded foil outer conductor is rated conservatively at > 90 dB (i.e. >180 dB between two adjacent cables).

• **Weatherability:** LMR-200-UF cables are designed for outdoor exposure and have a life expectancy in excess of 10 years.

• **Connectors:** A wide variety of connectors are available for LMR-200-UF cable, including all common interface types, reverse polarity, and solder-on center pins. Most LMR connectors employ crimp outer attachment using standard hex crimp sizes.

• **Cable Assemblies:** All LMR-200-UF cable types are available as pre-terminated cable assemblies. Refer to the section on FlexTech for further details.

Construction Specifications

Description	Material	In.	(mm)
Inner Conductor	Stranded BC	0.044	(1.12)
Dielectric	Foam Polyethylene	0.116	(2.95)
Outer Conductor	Aluminum Tape	0.121	(3.07)
Overall Braid	Tinned Copper	0.144	(3.66)
Jacket	Black Thermoplastic Elastomer	0.195	(4.95)

Mechanical Specifications

Performance Property	Units	US	(metric)
Bend Radius: installation	in. (mm)	0.5	(12.7)
Bend Radius: repeated	in. (mm)	2	(50.8)
Bending Moment	ft-lb (N-m)	0.1	(0.14)
Weight	lb/ft (kg/m)	0.022	(0.03)
Tensile Strength	lb (kg)	40	(18.2)
Flat Plate Crush	lb/in. (kg/mm)	10	(0.18)

Environmental Specifications

Performance Property	°F	°C
Installation Temperature Range	-40/+185	-40/+85
Storage Temperature Range	-94/+185	-70/+85
Operating Temperature Range	-40/+185	-40/+85

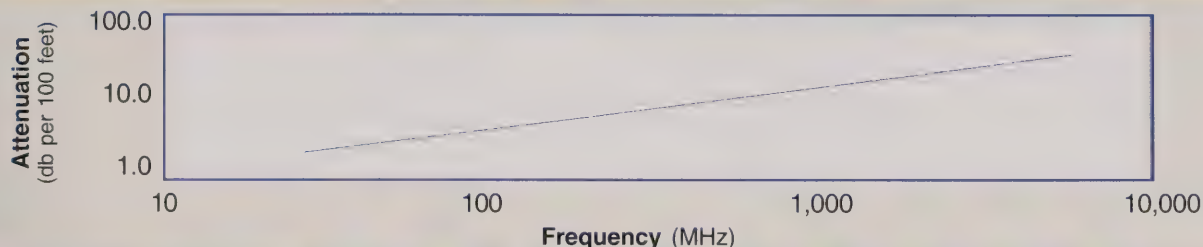
Electrical Specifications

Performance Property	Units	US	(metric)
Cutoff Frequency	GHz	39	
Velocity of Propagation	%	83	
Dielectric Constant	NA	1.45	
Time Delay	nS/ft (nS/m)	1.22	(4.02)
Impedance	ohms	50	
Capacitance	pF/ft (pF/m)	24.5	(80.3)
Inductance	uH/ft (uH/m)	0.061	(0.20)
Shielding Effectiveness	dB	>90	
DC Resistance			
Inner Conductor	ohms/1000ft (/km)	7.5	(24.6)
Outer Conductor	ohms/1000ft (/km)	4.9	(16.1)
Voltage Withstand	Volts DC	1000	
Jacket Spark	Volts RMS	3000	
Peak Power	kW	2.5	

Part Description

Part No.	Application	Jacket	Color	Stock Code
LMR-200-UF	Indoor/Outdoor	TPE	Black	54042

Attenuation vs. Frequency (typical)



Frequency (MHz)	30	50	150	220	450	900	1500	1800	2000	2500	5800
Attenuation dB/100 ft	2.1	2.7	4.8	5.8	8.3	11.9	15.5	17.1	18.0	20.2	31.6
Attenuation dB/100 m	7.0	9.0	15.7	19.0	27.4	39.1	50.9	55.9	59.1	66.4	103.8
Avg. Power kW	0.95	0.73	0.42	0.35	0.24	0.17	0.13	0.12	0.11	0.10	0.06

Calculate Attenuation = $(0.385082) \cdot \sqrt{\text{FMHz}} + (0.000396) \cdot \text{FMHz}$ (interactive calculator available at <http://www.timesmicrowave/telecom>)
 Attenuation: VSWR=1.0; Ambient = +25°C (77°F) Power: VSWR=1.0; Ambient = +40°C; Inner Conductor = 100°C (212°F);
 Sea Level; dry air; atmospheric pressure; no solar loading



Connectors

Interface	Description	Part Number	Stock Code	VSWR** Freq. (GHz)	Coupling Nut	Inner Contact Attach	Outer Contact Attach	Finish* Body /Pin	Length in (mm)	Width in (mm)	Weight lb (g)
N male	Straight Plug	TC-200-NM	3190-224	<1.25:1 (2.5)	Knurl	Solder	Crimp	S/G	1.5 (38.1)	0.75 (19.1)	0.073 (33.1)
BNC male	Straight Plug	TC-200-BM	3190-225	<1.25:1 (2.5)	Knurl	Solder	Crimp	S/G	1.7 (43.2)	0.56 (14.2)	0.045 (20.4)
TNC male	Straight Plug	TC-200-TMC	3190-240	<1.25:1 (2.5)	Knurl	Solder	Clamp	S/G	1.7 (43.2)	0.59 (15.0)	0.045 (20.4)
TNC female	Straight Jack	TC-200-TF	3190-263	<1.25:1 (2.5)	NA	Solder	Crimp	NG	1.3 (33.0)	0.57 (14.5)	0.033 (15.0)
SMA male	Straight Plug	TC-200-SM	3190-612	<1.25:1 (8)	Hex	Solder	Crimp	SS/G	1.0 (25.4)	0.32 (8.1)	0.015 (6.8)
SMA male	Reverse Polarity	TC-200-SM-RP	3190-327	<1.25:1 (2.5)	Hex	Solder	Crimp	SS/G	1.0 (25.4)	0.32 (8.1)	0.015 (6.8)
Mini-UHF	Straight Plug	TC-200-MUHF	3190-444	<1.25:1 (2.5)	Knurl	Solder	Crimp	NG	1.1 (27.9)	0.45 (11.4)	0.015 (6.8)

* Finish metals: N=Nickel, S=Silver, G=Gold, SS=Stainless Steel, A=Alballoy **VSWR spec based on 3 foot cable with a connector pair

Hardware Accessories

Type	Part Number	Stock Code	Description
Ground Kit	GK-S200T	GK-S200T	Standard Ground Kit (each)

Install Tools

Type	Part Number	Stock Code	Description
Crimp Tool	CT-240/200/195/100	3190-667	Crimp tool for LMR 200 connectors
Cutting Tool	CCT-01	3190-1544	Cable end flush cut tool
Replacement Blades	RB-01	3190-1609	Replacement blades for cutting tool



TIMES MICROWAVE SYSTEMS

A Smiths Group plc company

LMR-240-UF UltraFlex Communications Coax

Ideal for...

- Jumper Assemblies in Wireless Communications Systems
- Short Antenna Feeder runs (e.g. WLL, GPS, LMR, Mobile Antennas)
- Any application that requires periodic/repeated flexing



• **LMR® - UltraFlex** has a stranded center conductor and rubber outer jacket designed for multiple bending/flexing cycles. It is used for both indoor and outdoor applications.

• **Flexibility** and bendability are hallmarks of the LMR-240-UF cable design. The flexible outer conductor enables the tightest bend radius available for any cable of similar size and performance.

• **Low Loss** is another hallmark feature of LMR-240-UF. Size for size LMR has the lowest loss of any flexible cable and comparable loss to semirigid hard-line cables.

• **RF Shielding** is 50 dB greater than typical single shielded coax (40 dB). The multi-ply bonded foil outer conductor is rated conservatively at > 90 dB (i.e. >180 dB between two adjacent cables).

• **Weatherability:** LMR-240-UF cables are designed for outdoor exposure and have a life expectancy in excess of 10 years.

• **Connectors:** A wide variety of connectors are available for LMR-240-UF cable, including all common interface types, reverse polarity, and solder-on center pins. Most LMR connectors employ crimp outer attachment using standard hex crimp sizes.

• **Cable Assemblies:** All LMR-240-UF cable types are available as pre-terminated cable assemblies. Refer to the section on FlexTech for further details.

Construction Specifications				
Description	Material	In.	(mm)	
Inner Conductor	Stranded BC	0.056	(1.42)	
Dielectric	Foam Polyethylene	0.150	(3.81)	
Outer Conductor	Aluminum Tape	0.155	(3.94)	
Overall Braid	Tinned Copper	0.178	(4.52)	
Jacket	Black Thermoplastic Elastomer	0.240	(6.10)	

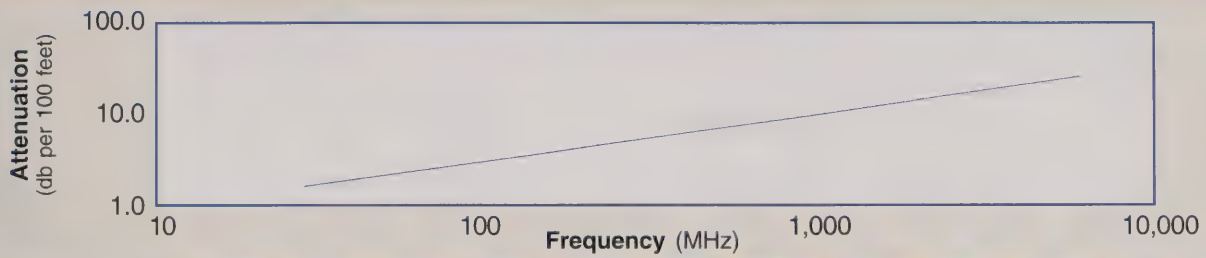
Mechanical Specifications				
Performance Property	Units	US	(metric)	
Bend Radius: installation	in. (mm)	0.75	(19.1)	
Bend Radius: repeated	in. (mm)	2.5	(63.5)	
Bending Moment	ft-lb (N-m)	0.125	(0.17)	
Weight	lb/ft (kg/m)	0.034	(0.05)	
Tensile Strength	lb (kg)	80	(36.3)	
Flat Plate Crush	lb/in. (kg/mm)	13	(0.23)	

Environmental Specifications			
Performance Property	°F	°C	
Installation Temperature Range	-40/+185	-40/+85	
Storage Temperature Range	-94/+185	-70/+85	
Operating Temperature Range	-40/+185	-40/+85	

Electrical Specifications				
Performance Property	Units	US	(metric)	
Cutoff Frequency	GHz		31	
Velocity of Propagation	%		84	
Dielectric Constant	NA		1.42	
Time Delay	nS/ft (nS/m)	1.21	(3.97)	
Impedance	ohms		50	
Capacitance	pF/ft (pF/m)	24.2	(79.4)	
Inductance	uH/ft (uH/m)	0.060	(0.20)	
Shielding Effectiveness	dB		>90	
DC Resistance				
Inner Conductor	ohms/1000ft (/km)	3.8	(12.6)	
Outer Conductor	ohms/1000ft (/km)	3.89	(12.8)	
Voltage Withstand	Volts DC		1500	
Jacket Spark	Volts RMS		5000	
Peak Power	kW		5.6	

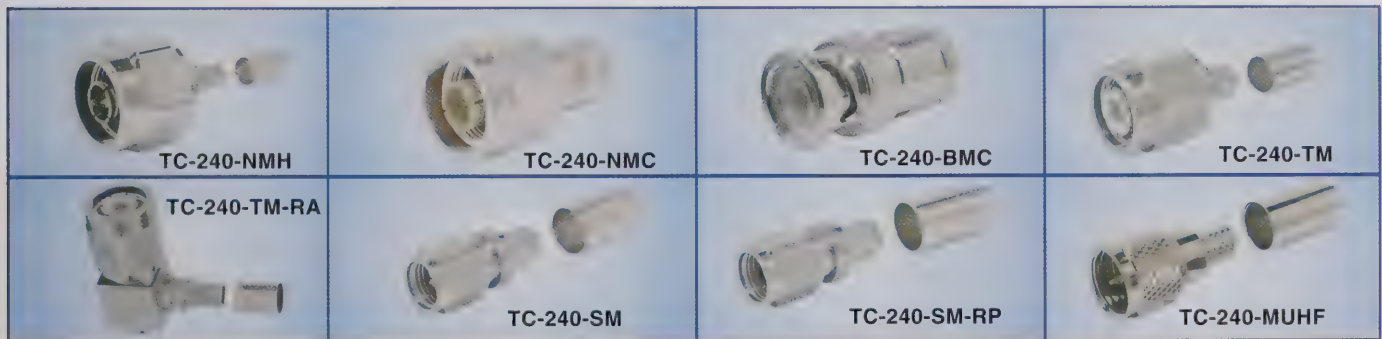
Part Description				
Part No.	Application	Jacket	Color	Stock Code
LMR-240-UF	Indoor/Outdoor	TPE	Black	54041

Attenuation vs. Frequency (typical)



Frequency (MHz)	30	50	150	220	450	900	1500	1800	2000	2500	5800
Attenuation dB/100 ft	1.6	2.1	3.6	4.4	6.3	9.1	11.8	13.0	13.8	15.5	24.4
Attenuation dB/100 m	5.3	6.8	11.9	14.4	20.8	29.8	38.9	42.8	45.2	50.9	80.1
Avg. Power kW	1.24	0.96	0.55	0.45	0.31	0.22	0.17	0.15	0.14	0.13	0.08

Calculate Attenuation = $(0.290501) \cdot \sqrt{\text{FMHz}} + (0.000396) \cdot \text{FMHz}$ (interactive calculator available at <http://www.timesmicrowave/telecom>)
 Attenuation: VSWR=1.0; Ambient = +25°C (77°F) Power: VSWR=1.0; Ambient = +40°C; Inner Conductor = 100°C (212°F);
 Sea Level; dry air; atmospheric pressure; no solar loading



Connectors

Interface	Description	Part Number	Stock Code	VSWR** Freq. (GHz)	Coupling Nut	Inner Contact Attach	Outer Contact Attach	Finish* Body /Pin	Length in (mm)	Width in (mm)	Weight lb (g)
N Male	Straight Plug	TC-240-NMH	3190-382	<1.25:1 (2.5)	Hex	Solder	Crimp	NS	1.5 (38)	0.75 (19.1)	0.086 (39.0)
N Male	Straight Plug	TC-240-NMC	3190-244	<1.25:1 (2.5)	Knurl	Solder	Clamp	S/G	1.5 (38)	0.75 (19.1)	0.082 (37.2)
BNC Male	Straight Plug	TC-240-BMC	3190-242	<1.25:1 (2.5)	Knurl	Solder	Clamp	S/G	1.7 (43)	0.56 (14.2)	0.040 (18.1)
TNC Male	Straight Plug	TC-240-TM	3190-275	<1.25:1 (2.5)	Knurl	Solder	Crimp	NS	1.7 (43)	0.59 (15.0)	0.043 (19.5)
TNC Male	Right Angle	TC-240-TM-RA	3190-604	<1.35:1 (6)	Knurl	Solder	Crimp	NG	1.3 (33)	0.57 (14.5)	0.055 (24.9)
SMA Male	Straight Plug	TC-240-SM	3190-380	<1.25:1 (10)	Hex	Solder	Crimp	SS/G	1.0 (25)	0.32 (8.1)	0.016 (7.3)
SMA Male	Reverse Polarity	TC-240-SM-RP	3190-326	<1.25:1 (2.5)	Hex	Solder	Crimp	SS/G	1.0 (25)	0.32 (8.1)	0.016 (7.3)
Mini-UHF	Straight Plug	TC-240-MUHF	3190-445	<1.25:1 (2.5)	Knurl	Solder	Crimp	NG	1.1 (28)	0.45 (11.4)	0.014 (6.4)

* Finish metals: N=Nickel, S=Silver, G=Gold, SS=Stainless Steel, A=Alballoy **VSWR spec based on 3 foot cable with a connector pair

Hardware Accessories

Type	Part Number	Stock Code	Description
Ground Kit	GK-S240T	GK-S240T	Standard Ground Kit (each)

Install Tools

Type	Part Number	Stock Code	Description
Crimp Tool	CT-240/200/195/100	3190-667	Crimp tool for LMR 240 connectors
Cutting Tool	CCT-01	3190-1544	Cable end flush cut tool
Replacement Blades	RB-01	3190-1609	Replacement blades for cutting tool



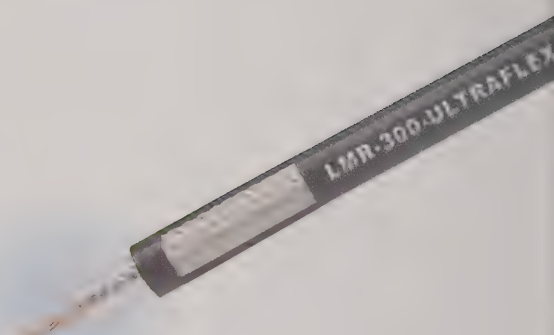
TIMES MICROWAVE SYSTEMS

A Smiths Group plc company

LMR-300-UF UltraFlex Communications Coax

Ideal for...

- Jumper Assemblies in Wireless Communications Systems
- Short Antenna Feeder runs
- Any application that requires periodic/repeated flexing



• **LMR® - UltraFlex** has a stranded center conductor and rubber outer jacket designed for multiple bending/flexing cycles. It is used for both indoor and outdoor applications.

• **Flexibility** and bendability are hallmarks of the LMR-300-UF cable design. The flexible outer conductor enables the tightest bend radius available for any cable of similar size and performance.

• **Low Loss** is another hallmark feature of LMR-300-UF. Size for size LMR has the lowest loss of any flexible cable and comparable loss to semirigid hard-line cables.

• **RF Shielding** is 50 dB greater than typical single shielded coax (40 dB). The multi-ply bonded foil outer conductor is rated conservatively at > 90 dB (i.e. >180 dB between two adjacent cables).

• **Weatherability:** LMR-300-UF cables are designed for outdoor exposure and have a life expectancy in excess of 10 years.

• **Connectors:** A wide variety of connectors are available for LMR-300-UF cable, including all common interface types, reverse polarity, and solder-on center pins. Most LMR connectors employ crimp outer attachment using standard hex crimp sizes.

• **Cable Assemblies:** All LMR-300-UF cable types are available as pre-terminated cable assemblies. Refer to the section on FlexTech for further details.

Construction Specifications			
Description	Material	In.	(mm)
Inner Conductor	Stranded BC	0.070	(1.78)
Dielectric	Foam Polyethylene	0.190	(4.83)
Outer Conductor	Aluminum Tape	0.196	(4.98)
Overall Braid	Tinned Copper	0.225	(5.72)
Jacket	Black Thermoplastic Elastomer	0.300	(7.62)

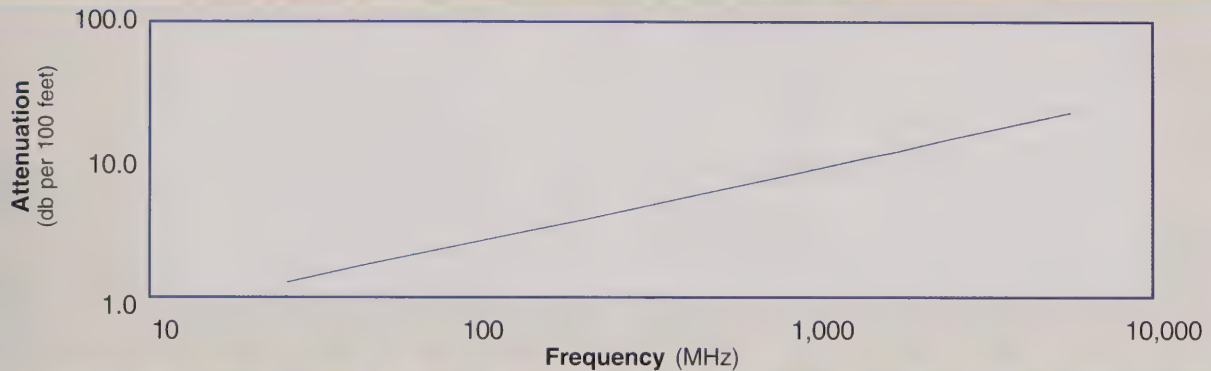
Mechanical Specifications			
Performance Property	Units	US	(metric)
Bend Radius: installation	in. (mm)	0.875	(22.2)
Bend Radius: repeated	in. (mm)	3.0	(76.2)
Bending Moment	ft-lb (N-m)	0.2	(0.27)
Weight	lb/ft (kg/m)	0.055	(0.08)
Tensile Strength	lb (kg)	120	(54.5)
Flat Plate Crush	lb/in. (kg/mm)	20	(0.36)

Environmental Specifications			
Performance Property	°F	°C	
Installation Temperature Range	-40/+185	-40/+85	
Storage Temperature Range	-94/+185	-70/+85	
Operating Temperature Range	-40/+185	-40/+85	

Electrical Specifications			
Performance Property	Units	US	(metric)
Cutoff Frequency	GHz	25	
Velocity of Propagation	%	85	
Dielectric Constant	NA	1.38	
Time Delay	nS/ft (nS/m)	1.20	(3.92)
Impedance	ohms	50	
Capacitance	pF/ft (pF/m)	23.9	(78.4)
Inductance	uH/ft (uH/m)	0.060	(0.20)
Shielding Effectiveness	dB	>90	
DC Resistance			
Inner Conductor	ohms/1000ft (/km)	2.96	(9.7)
Outer Conductor	ohms/1000ft (/km)	2.21	(7.35)
Voltage Withstand	Volts DC	2000	
Jacket Spark	Volts RMS	5000	
Peak Power	kW	10	

Part Description				
Part No.	Application	Jacket	Color	Stock Code
LMR-300-UF	Indoor/Outdoor	TPE	Black	54088

Attenuation vs. Frequency (typical)



Frequency (MHz)	30	50	150	220	450	900	1500	1800	2000	2500	5800
Attenuation dB/100 ft	1.3	1.6	2.9	3.5	5.1	7.3	9.5	10.5	11.1	12.5	19.8
Attenuation dB/100 m	4.2	5.4	9.4	11.5	16.6	23.8	31.2	34.4	36.4	41.0	65.0
Avg. Power kW	1.74	1.35	0.77	0.63	0.44	0.30	0.23	0.21	0.20	0.18	0.11

Calculate Attenuation = $(0.230316) \cdot \sqrt{\text{FMHz}} + (0.000392) \cdot \text{FMHz}$ (interactive calculator available at <http://www.timesmicrowave/telecom>)
 Attenuation: VSWR=1.0; Ambient = +25°C (77°F) Power: VSWR=1.0; Ambient = +40°C; Inner Conductor = 100°C (212°F);
 Sea Level; dry air; atmospheric pressure; no solar loading



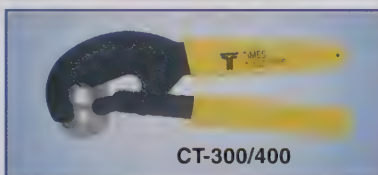
Connectors

Interface	Description	Part Number	Stock Code	VSWR** Freq. (GHz)	Coupling Nut	Inner Contact Attach	Outer Contact Attach	Finish* Body /Pin	Length in (mm)	Width in (mm)	Weight lb (g)
N Male	Straight Plug	TC-300-NM	3190-498	<1.25:1 (6)	Knurl	Solder	Crimp	NS	1.6 (41)	0.85 (21.6)	0.074 (33.8)
N Male	Right Angle	TC-300-NM-RA	3190-499	<1.35:1 (25)	Knurl	Solder	Crimp	NS	1.5 (38)	0.85 (21.6)	0.101 (45.8)
TNC Male	Straight Plug	TC-300-TM	3190-500	<1.25:1 (25)	Knurl	Solder	Crimp	NS	1.7 (43)	0.59 (15.0)	0.050 (22.7)
SMA Male	Straight Plug	TC-300-SM	3190-501	<1.25:1 (25)	Hex	Solder	Crimp	SS/G	1.0 (25)	0.35 (8.9)	0.018 (8.2)
SMA Female	Bulkhead Jack	TC-300-SF-BH	3190-590	<1.25:1 (25)	NA	Solder	Crimp	SS/G	1.1 (28)	0.31 (7.9)	0.022 (10.0)

* Finish metals: N=Nickel, S=Silver, G=Gold, SS=Stainless Steel, A=Alballoy **VSWR spec based on 3 foot cable with a connector pair

Hardware Accessories

Type	Part Number	Stock Code	Description
Ground Kit	GK-S300T	GK-S300T	Standard Ground Kit (each)



CT-300/400



CCT-01

Install Tools

Type	Part Number	Stock Code	Description
Crimp Tool	CT-300/400	3190-666	Crimp tool for LMR-300 UF connectors
Cutting Tool	CCT-01	3190-1544	Cable end flush cut tool
Replacement Blades	RB-01	3190-1609	Replacement blades for cutting tool

TIMES MICROWAVE SYSTEMS

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LMR-400-UF UltraFlex Communications Coax

Ideal for...

- Drop-in replacement for RG-8/9913 Air-Dielectric type Cable
- Jumper Assemblies in Wireless Communications Systems
- Short Antenna Feeder runs
- Any application that requires periodic/repeated flexing



• **LMR® - UltraFlex** has a stranded center conductor and rubber outer jacket designed for multiple bending/flexing cycles. It is used for both indoor and outdoor applications.

• **Flexibility** and bendability are hallmarks of the LMR-400-UF cable design. The flexible outer conductor enables the tightest bend radius available for any cable of similar size and performance.

• **Low Loss** is another hallmark feature of LMR-400-UF. Size for size LMR has the lowest loss of any flexible cable and comparable loss to semirigid hard-line cables.

• **RF Shielding** is 50 dB greater than typical single shielded coax (40 dB). The multi-ply bonded foil outer conductor is rated conservatively at > 90 dB (i.e. >180 dB between two adjacent cables).

• **Weatherability:** LMR-400-UF cables are designed for outdoor exposure and have a life expectancy in excess of 10 years.

• **Connectors:** A wide variety of connectors are available for LMR-400-UF cable, including all common interface types, reverse polarity, and solder-on center pins. Most LMR connectors employ crimp outer attachment using standard hex crimp sizes.

• **Cable Assemblies:** All LMR-400-UF cable types are available as pre-terminated cable assemblies. Refer to the section on FlexTech for further details.

Part Description				
Part No.	Application	Jacket	Color	Stock Code
LMR-400-UF	Indoor/Outdoor	TPE	Black	54040

Construction Specifications			
Description	Material	In.	(mm)
Inner Conductor	Stranded BC	0.108	(2.74)
Dielectric	Foam Polyethylene	0.285	(7.24)
Outer Conductor	Aluminum Tape	0.291	(7.39)
Overall Braid	Tinned Copper	0.320	(8.13)
Jacket	Black Thermoplastic Elastomer	0.405	(10.29)

Mechanical Specifications

Performance Property	Units	US	(metric)
Bend Radius: installation	in. (mm)	1.0	(25.4)
Bend Radius: repeated	in. (mm)	4.0	(101.6)
Bending Moment	ft-lb (N-m)	0.375	(0.51)
Weight	lb/ft (kg/m)	0.09	(0.13)
Tensile Strength	lb (kg)	160	(72.6)
Flat Plate Crush	lb/in. (kg/mm)	20	(0.36)

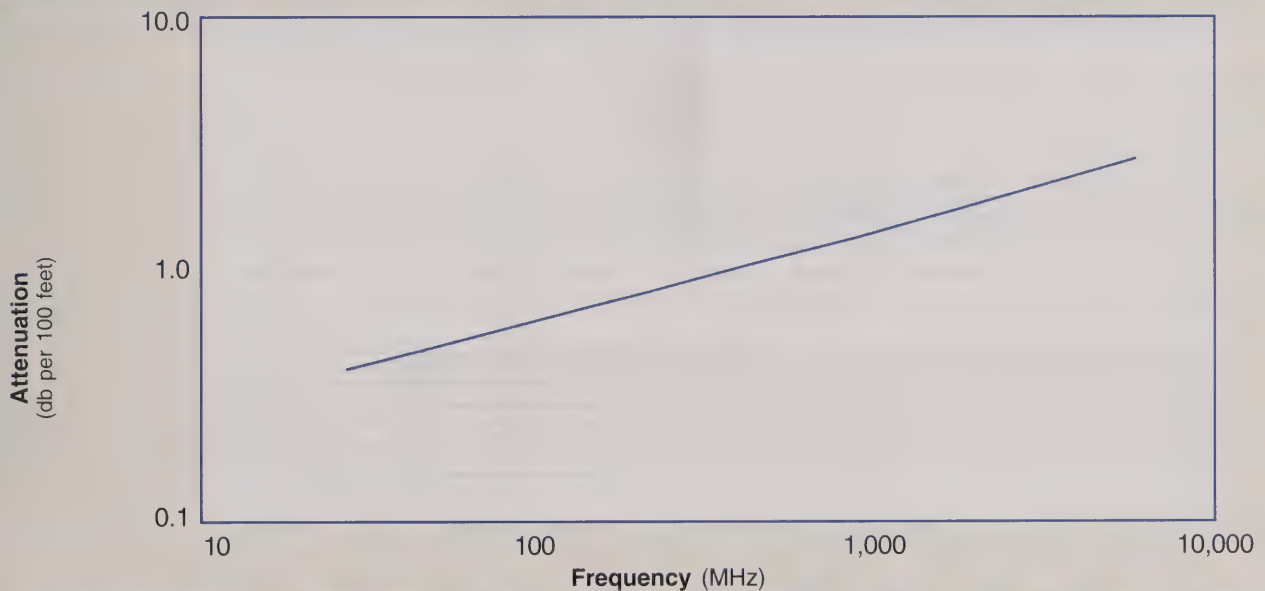
Environmental Specifications

Performance Property	°F	°C
Installation Temperature Range	-40/+185	-40/+85
Storage Temperature Range	-94/+185	-70/+85
Operating Temperature Range	-40/+185	-40/+85

Electrical Specifications

Performance Property	Units	US	(metric)
Cutoff Frequency	GHz	16.2	
Velocity of Propagation	%	85	
Dielectric Constant	NA	1.38	
Time Delay	nS/ft (nS/m)	1.20	(3.92)
Impedance	ohms	50	
Capacitance	pF/ft (pF/m)	23.9	(78.40)
Inductance	uH/ft (uH/m)	0.064	(0.21)
Shielding Effectiveness	dB	>90	
DC Resistance			
Inner Conductor	ohms/1000ft (/km)	1.39	(4.56)
Outer Conductor	ohms/1000ft (/km)	1.65	(6.41)
Voltage Withstand	Volts DC	2500	
Jacket Spark	Volts RMS	8000	
Peak Power	kW	16	

Attenuation vs. Frequency (typical)



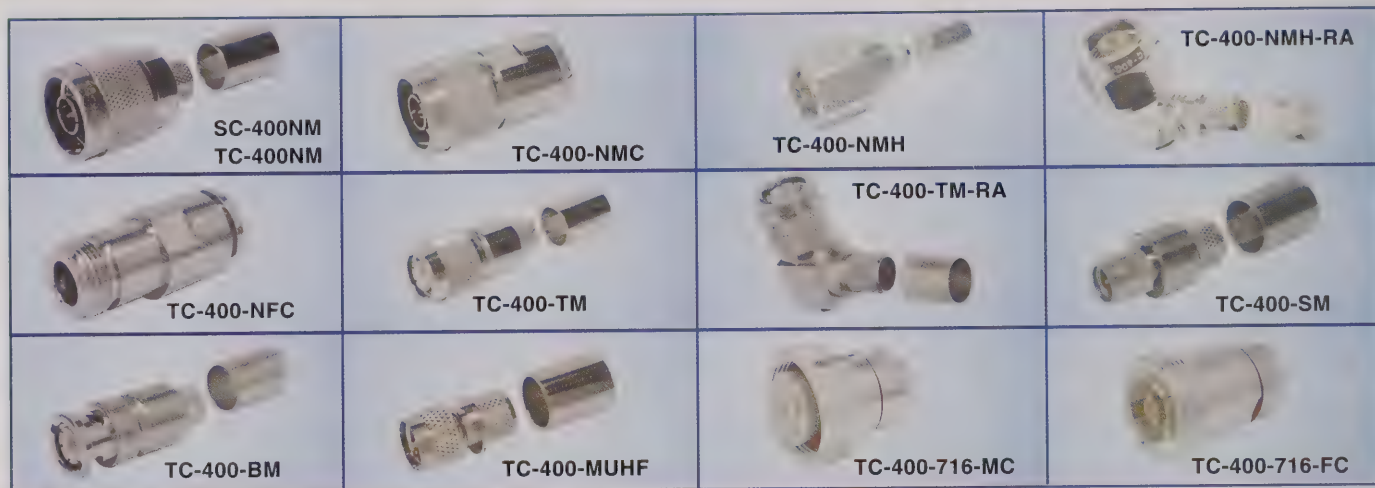
Frequency (MHz)	30	50	150	220	450	900	1500	1800	2000	2500	5800
Attenuation dB/100 ft	0.8	1.1	1.8	2.2	3.3	4.7	6.2	6.8	7.2	8.1	13.0
Attenuation dB/100 m	2.7	3.5	6.1	7.4	10.7	15.4	20.2	22.3	23.6	26.6	42.6
Avg. Power kW	2.77	2.14	1.22	1.00	0.69	0.48	0.36	0.33	0.31	0.28	0.17

Calculate Attenuation = $(0.146748) \cdot \sqrt{\text{FMHz}} + (0.000312) \cdot \text{FMHz}$ (interactive calculator available at <http://www.timesmicrowave/telecom>)
 Attenuation: VSWR=1.0; Ambient = +25°C (77°F) Power: VSWR=1.0; Ambient = +40°C; Inner Conductor = 100°C (212°F);
 Sea Level; dry air; atmospheric pressure; no solar loading

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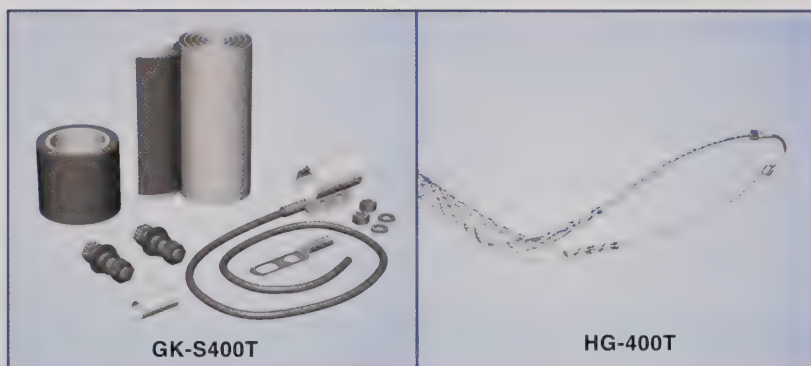
LMR-400-UF UltraFlex Communications Coax



Connectors

Interface	Description	Part Number	Stock Code	VSWR** Freq. (GHz)	Coupling Nut	Inner Contact Attach	Outer Contact Attach	Finish* Body /Pin	Length in (mm)	Width in (mm)	Weight lb (g)
N Male	Straight Plug	SC-400-NM	3190-1454	<1.25:1 (2.5)	Knurl	Solder	Crimp	NG	1.5 (38)	0.75 (19.1)	0.090 (40.8)
	Straight Plug	TC-400-NM	3190-188	<1.25:1 (2.5)	Knurl	Solder	Crimp	NG	1.5 (38)	0.75 (19.1)	0.090 (40.8)
	Straight Plug	TC-400-NMC	3190-277	<1.25:1 (2.5)	Knurl	Solder	Clamp	NG	1.5 (38)	0.75 (19.1)	0.121 (54.9)
	Straight Plug	TC-400-NMH	3190-552	<1.25:1 (10)	Hex	Solder	Crimp	S/G	1.5 (38)	0.89 (22.6)	0.113 (51.3)
	Right Angle	TC-400-NMH-RA	3190-422	<1.35:1 (6)	Hex	Solder	Crimp	S/G	1.8 (46)	1.25 (31.8)	0.130 (59.0)
N Female	Straight Jack	TC-400-NFC	3190-299	<1.25:1 (2.5)	NA	Solder	Clamp	NS	1.6 (41)	0.75 (19.1)	0.119 (54.0)
TNC Male	Straight Plug	TC-400-TM	3190-260	<1.25:1 (2.5)	Knurl	Solder	Crimp	NS	1.7 (43)	0.59 (15.0)	0.074 (33.6)
	Right Angle	TC-400-TM-RA	3190-442	<1.35:1 (2.5)	Knurl	Solder	Crimp	NG	1.7 (43)	0.59 (15.0)	0.085 (38.6)
SMA Male	Straight Plug	TC-400-SM	3190-439	<1.25:1 (8)	Hex	Solder	Crimp	NG	1.2 (29)	0.50 (12.7)	0.032 (14.5)
BNC Male	Straight Plug	TC-400-BM	3190-318	<1.25:1 (2.5)	Knurl	Solder	Crimp	NS	1.7 (43)	0.56 (14.2)	0.063 (28.6)
Mini-UHF	Straight Plug	TC-400-MUHF	3190-520	<1.25:1 (2.5)	Knurl	Solder	Crimp	NG	1.1 (28)	0.50 (12.7)	0.020 (9.1)
7-16 DIN Male	Straight Plug	TC-400-716-MC	3190-279	<1.25:1 (2.5)	Hex	Solder	Clamp	SS	1.4 (36)	1.40 (35.6)	0.268 (121.6)
7-16 DIN Female	Straight Jack	TC-400-716-FC	3190-376	<1.25:1 (2.5)	NA	Solder	Clamp	SS	1.6 (41)	1.13 (28.7)	0.281 (127.5)

* Finish metals: N=Nickel, S=Silver, G=Gold, SS=Stainless Steel, A=Alballoy **VSWR spec based on 3 foot cable with a connector pair



Hardware Accessories

Type	Part Number	Stock Code	Description
Ground Kit	GK-S400T	GK-S400T	Standard Grounding Kit (each)
Hoisting Grip	HG-400T	HG-400T	Laced Type (each)



Install Tools

Type	Part Number	Stock Code	Description
Crimp Tool	HX-4	3190-200	Crimp Handle
Crimp Dies	Y1719	3190-202	.429" Hex Dies
Crimp Tool	CT-400/300	3190-666	Crimp tool for LMR 400 connectors
Crimp Rings	CR-400	3190-830	Crimp rings for TC/EZ-400 connectors (package of 10)
Strip Tool	ST-400C	3190-228	For Clamp Connectors
Strip Tool	ST-400EZ	3190-401	For Crimp Connectors
Cutting Tool	CCT-01	3190-1544	Cable end flush cut tool
Replacement Blades	RB-01	3190-1609	Replacement blades for cutting tool

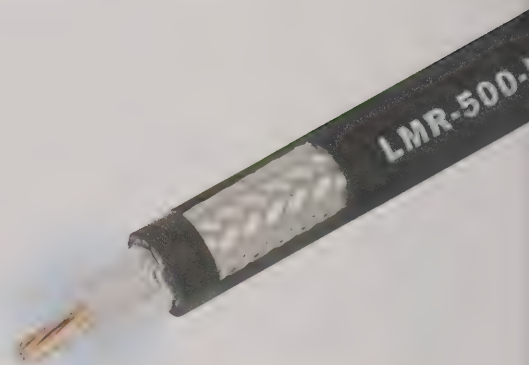
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LMR-500-UF UltraFlex Communications Coax

Ideal for...

- Jumper Assemblies in Wireless Communications Systems
- Short Antenna Feeder runs
- Any application that requires periodic/repeated flexing



• **LMR® - UltraFlex** has a stranded center conductor and rubber outer jacket designed for multiple bending/flexing cycles. It is used for both indoor and outdoor applications.

• **Flexibility** and bendability are hallmarks of the LMR-500-UF cable design. The flexible outer conductor enables the tightest bend radius available for any cable of similar size and performance.

• **Low Loss** is another hallmark feature of LMR-500-UF. Size for size LMR has the lowest loss of any flexible cable and comparable loss to semirigid hard-line cables.

• **RF Shielding** is 50 dB greater than typical single shielded coax (40 dB). The multi-ply bonded foil outer conductor is rated conservatively at > 90 dB (i.e. >180 dB between two adjacent cables).

• **Weatherability:** LMR-500-UF cables are designed for outdoor exposure and have a life expectancy in excess of 10 years.

• **Connectors:** A wide variety of connectors are available for LMR-500-UF cable, including all common interface types, reverse polarity, and solder-on center pins. Most LMR connectors employ crimp outer attachment using standard hex crimp sizes.

• **Cable Assemblies:** All LMR-500-UF cable types are available as pre-terminated cable assemblies. Refer to the section on FlexTech for further details.

Construction Specifications

Description	Material	In.	(mm)
Inner Conductor	Stranded BC	0.142	(3.61)
Dielectric	Foam Polyethylene	0.370	(9.40)
Outer Conductor	Aluminum Tape	0.376	(9.55)
Overall Braid	Tinned Copper	0.405	(10.29)
Jacket	Black Thermoplastic Elastomer	0.500	(12.70)

Mechanical Specifications

Performance Property	Units	US	(metric)
Bend Radius: installation	in. (mm)	1.25	(31.8)
Bend Radius: repeated	in. (mm)	5.0	(127.0)
Bending Moment	ft-lb (N-m)	1.25	(1.69)
Weight	lb/ft (kg/m)	0.1	(0.15)
Tensile Strength	lb (kg)	260	(118.0)
Flat Plate Crush	lb/in. (kg/mm)	35	(0.63)

Environmental Specifications

Performance Property	°F	°C
Installation Temperature Range	-40/+185	-40/+85
Storage Temperature Range	-94/+185	-70/+85
Operating Temperature Range	-40/+185	-40/+85

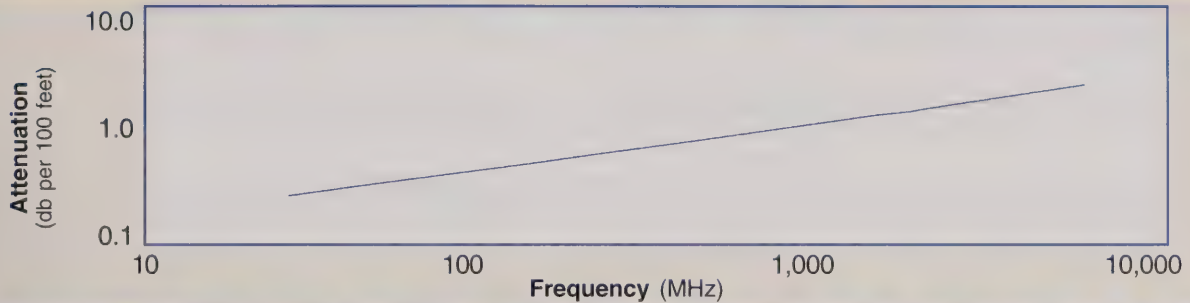
Electrical Specifications

Performance Property	Units	US	(metric)
Cutoff Frequency	GHz	12	
Velocity of Propagation	%	85	
Dielectric Constant	NA	1.38	
Time Delay	nS/ft (nS/m)	1.20	(3.92)
Impedance	ohms	50	
Capacitance	pF/ft (pF/m)	23.9	(78.4)
Inductance	uH/ft (uH/m)	0.060	(0.20)
Shielding Effectiveness	dB	>90	
DC Resistance			
Inner Conductor	ohms/1000ft (/km)	0.86	(2.8)
Outer Conductor	ohms/1000ft (/km)	1.65	(5.4)
Voltage Withstand	Volts DC	2500	
Jacket Spark	Volts RMS	8000	
Peak Power	kW	16	

Part Description

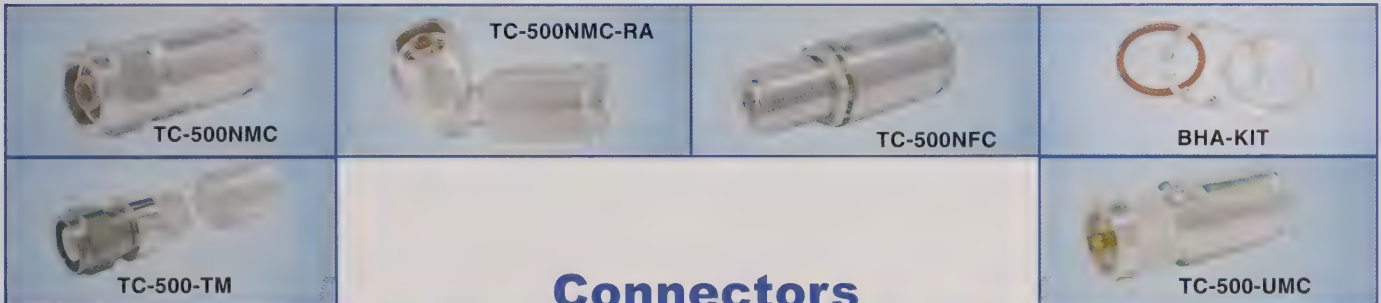
Part No.	Application	Jacket	Color	Stock Code
LMR-500-UF	Indoor/Outdoor	TPE	Black	54043

Attenuation vs. Frequency (typical)



Frequency (MHz)	30	50	150	220	450	900	1500	1800	2000	2500	5800
Attenuation dB/100 ft	0.6	0.8	1.5	1.8	2.6	3.8	5.0	5.5	5.8	6.6	10.6
Attenuation dB/100 m	2.1	2.7	4.8	5.9	8.5	12.3	16.3	18.0	19.1	21.6	34.9
Avg. Power kW	3.68	2.84	1.61	1.32	0.91	0.63	0.48	0.43	0.41	0.36	0.22

Calculate Attenuation = $(0.115908) \cdot \sqrt{\text{FMHz}} + (0.000312) \cdot \text{FMHz}$ (interactive calculator available at <http://www.timesmicrowave/telecom>)
 Attenuation: VSWR=1.0; Ambient = +25°C (77°F) Power: VSWR=1.0; Ambient = +40°C; Inner Conductor = 100°C (212°F);
 Sea Level; dry air; atmospheric pressure; no solar loading



Connectors

Interface	Description	Part Number	Stock Code	VSWR Freq. (GHz)	Coupling Nut	Inner Contact Attach	Outer Contact Attach	Finish* Body /Pin	Length in (mm)	Width in (mm)	Weight lb (g)
N Male	Straight Plug	TC-500-NMC	3190-377	<1.25:1 (2.5)	Hex	Solder	Clamp	S/G	2.1 (53)	0.92 (23.4)	0.228 (103.4)
	Right Angle	TC-500-NMC-RA	3190-227	<1.35:1 (2.5)	Hex	Solder	Clamp	S/G	2.4 (61)	1.5 (38.1)	0.275 (124.7)
N Female	Straight Jack	TC-500-NFC	3190-215	<1.25:1 (2.5)	NA	Solder	Clamp	S/G	2.2 (56)	0.94 (23.9)	0.215 (97.5)
	Bulkhead Kit	BHA-KIT	3190-223	<1.25:1 (2.5)	NA	NA	NA	NA	NA	NA	0.014 (6.4)
TNC Male	Straight Plug	TC-500-TM	3190-464	<1.25:1 (2.5)	Hex	Solder	Crimp	N/G	1.5 (38)	0.62 (15.7)	0.082 (28.1)
UHF Male	Straight Plug	TC-500-UMC	3190-354	<1.25:1 (2.5)	Knurl	Solder	Clamp	S/G	2.1 (53)	0.88 (22.4)	0.215 (97.5)

* Finish metals: N=Nickel, S=Silver, G=Gold, SS=Stainless Steel, A=Alballoy **VSWR spec based on 3 foot cable with a connector pair



Install Tools

Type	Part Number	Stock Code	Description
Crimp Tool	HX-4	3190-200	Crimp Handle
Crimp Dies	Y151	3190-465	.532" Hex Dies
Strip Tool	ST-500C	3190-229	For Clamp Style Connectors
Cutting Tool	CCT-01	3190-1544	Cable end flush cut tool
Replacement Blades	RB-01	3190-1609	Replacement blades for cutting tool

Hardware Accessories

Type	Part Number	Stock Code	Description
Ground Kit	GK-S500T	GK-S500T	Standard Ground Kit (each)



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LMR-600-UF

UltraFlex Communications Coax

Ideal for...

- Jumper Assemblies in Wireless Communications Systems
- Short Antenna Feeder runs
- Any application that requires periodic/repeated flexing



• **LMR® - UltraFlex** has a stranded center conductor and rubber outer jacket designed for multiple bending/flexing cycles. It is used for both indoor and outdoor applications.

• **Flexibility** and bendability are hallmarks of the LMR-600-UF cable design. The flexible outer conductor enables the tightest bend radius available for any cable of similar size and performance.

• **Low Loss** is another hallmark feature of LMR-600-UF. Size for size LMR has the lowest loss of any flexible cable and comparable loss to semirigid hard-line cables.

• **RF Shielding** is 50 dB greater than typical single shielded coax (40 dB). The multi-ply bonded foil outer conductor is rated conservatively at > 90 dB (i.e. >180 dB between two adjacent cables).

• **Weatherability:** LMR-600-UF cables are designed for outdoor exposure and have a life expectancy in excess of 10 years.

• **Connectors:** A wide variety of connectors are available for LMR-600-UF cable, including all common interface types, reverse polarity, and solder-on center pins. Most LMR connectors employ crimp outer attachment using standard hex crimp sizes.

• **Cable Assemblies:** All LMR-600-UF cable types are available as pre-terminated cable assemblies. Refer to the section on FlexTech for further details.

Part Description				
Part No.	Application	Jacket	Color	Stock Code
LMR-600-UF	Indoor/Outdoor	TPE	Black	54044

Construction Specifications			
Description	Material	In.	(mm)
Inner Conductor	Stranded BC	0.176	(4.47)
Dielectric	Foam Polyethylene	0.455	(11.56)
Outer Conductor	Aluminum Tape	0.461	(11.71)
Overall Braid	Tinned Copper	0.490	(12.45)
Jacket	Black Thermoplastic Elastomer	0.590	(14.99)

Mechanical Specifications

Performance Property	Units	US	(metric)
Bend Radius: installation	in. (mm)	1.5	(38.1)
Bend Radius: repeated	in. (mm)	3.0	(76.2)
Bending Moment	ft-lb (N-m)	1.75	(2.37)
Weight	lb/ft (kg/m)	0.165	(0.25)
Tensile Strength	lb (kg)	350	(158.9)
Flat Plate Crush	lb/in. (kg/mm)	40	(0.71)

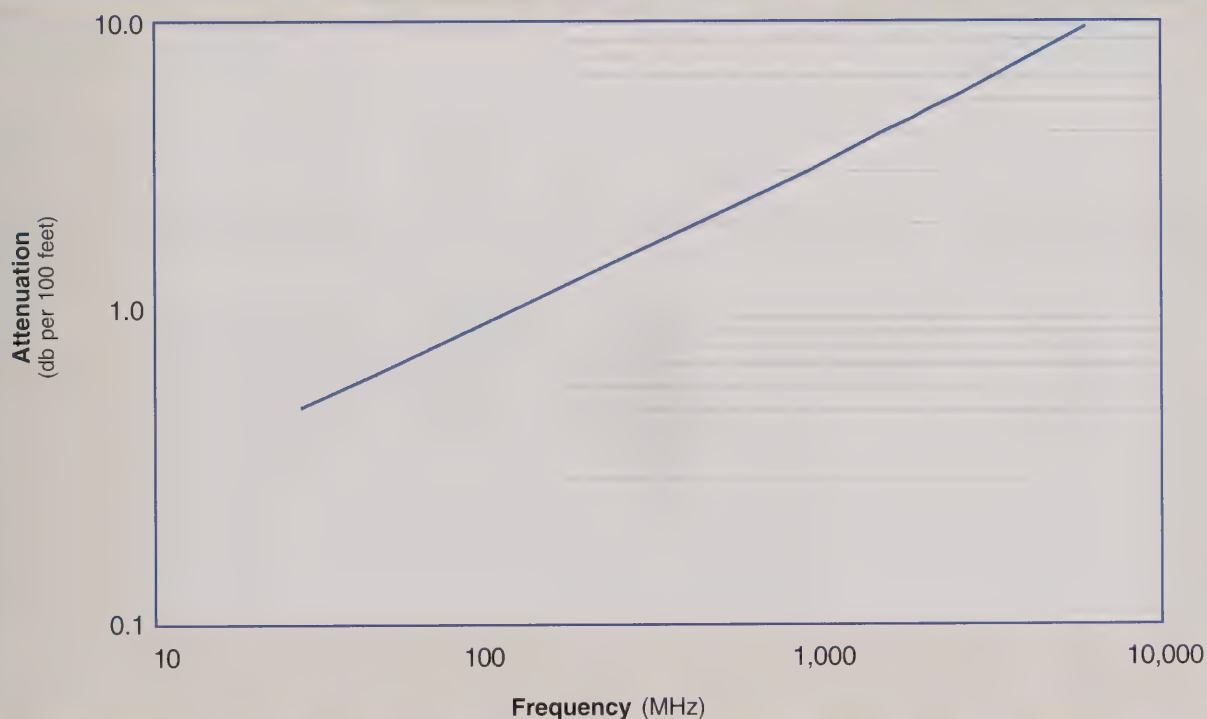
Environmental Specifications

Performance Property	°F	°C
Installation Temperature Range	-40/+185	-40/+85
Storage Temperature Range	-94/+185	-70/+85
Operating Temperature Range	-40/+185	-40/+85

Electrical Specifications

Performance Property	Units	US	(metric)
Cutoff Frequency	GHz	10	
Velocity of Propagation	%	87	
Dielectric Constant	NA	1.32	
Time Delay	nS/ft (nS/m)	1.17	(3.83)
Impedance	ohms	50	
Capacitance	pF/ft (pF/m)	23.4	(76.6)
Inductance	uH/ft (uH/m)	0.058	(0.19)
Shielding Effectiveness	dB	>90	
DC Resistance			
Inner Conductor	ohms/1000ft (/km)	0.56	(1.8)
Outer Conductor	ohms/1000ft (/km)	1.2	(3.9)
Voltage Withstand	Volts DC	4000	
Jacket Spark	Volts RMS	8000	
Peak Power	kW	40	

Attenuation vs. Frequency (typical)



Frequency (MHz)	30	50	150	220	450	900	1500	1800	2000	2500	5800
Attenuation dB/100 ft	0.5	0.7	1.2	1.4	2.1	3.0	4.0	4.4	4.7	5.3	8.7
Attenuation dB/100 m	1.7	2.2	3.8	4.6	6.8	9.8	13.1	14.5	15.3	17.4	28.6
Avg. Power kW	4.59	3.53	2.00	1.64	1.12	0.77	0.58	0.52	0.49	0.43	0.26

Calculate Attenuation =

$(0.090660) \cdot \sqrt{\text{FMHz}} + (0.000312) \cdot \text{FMHz}$ (interactive calculator available at <http://www.timesmicrowave/telecom>)

Attenuation:

VSWR=1.0; Ambient = +25°C (77°F)

Power:

VSWR=1.0; Ambient = +40°C; Inner Conductor = 100°C (212°F); Sea Level; dry air; atmospheric pressure; no solar loading

TIMES MICROWAVE SYSTEMS

A Smiths Group plc company

LMR-600-UF UltraFlex Communications Coax



Connectors

Interface	Description	Part Number	Stock Code	VSWR** Freq. (GHz)	Coupling Nut	Inner Contact Attach	Outer Contact Attach	Finish* Body /Pin	Length in (mm)	Width in (mm)	Weight lb (g)
N Male	Straight Plug	TC-600-NMH	3190-208	<1.25:1 (25)	Hex	Solder	Crimp	S/G	2.1 (53)	0.92 (23.4)	0.166 (75.3)
	Straight Plug	TC-600-NMC	3190-357	<1.25:1 (25)	Hex	Solder	Clamp	S/G	2.1 (53)	0.92 (23.4)	0.208 (93.4)
	Right Angle	TC-600-NMC-RA	3190-233	<1.35:1 (25)	Hex	Solder	Clamp	S/G	2.1 (53)	0.92 (23.4)	0.280 (117.9)
N Female	Bulkhead Jack	TC-600-NF-BH	3190-589	<1.25:1 (25)	NA	Solder	Crimp	S/G	2.4 (61)	0.88 (22.4)	0.195 (88.5)
	Bulkhead Jack	TC-600-NFC-BH	3190-466	<1.25:1 (25)	NA	Solder	Clamp	S/G	2.2 (56)	0.94 (23.9)	0.214 (97.1)
UHF Male	Straight Plug	TC-600-UMC	3190-213	<1.25:1 (25)	Knurl	Solder	Clamp	S/G	1.7 (43)	0.88 (22.4)	0.198 (89.8)
7-16 DIN Male	Straight Plug	TC-600-716-MC	3190-502	<1.25:1 (25)	Hex	Solder	Clamp	S/S	2.0 (51)	1.30 (33.0)	0.347 (157.4)
	Right Angle	TC-600-716M-RA	3190-395	<1.35:1 (25)	Hex	Solder	Crimp	S/S	1.4 (36)	1.40 (35.6)	0.354 (160.8)
7-16 DIN Female	Straight Jack	TC-600-716-FC	3190-375	<1.25:1 (25)	NA	Solder	Clamp	S/S	1.1 (28)	1.00 (25.4)	0.249 (112.9)
7/8 EIA	Flange	TC-600-78EIA	3190-321	<1.25:1 (25)	NA	Solder	Clamp	S/S	2.3 (58)	2.60 (66.0)	0.873 (396.0)

* Finish metals: N=Nickel, S=Silver, G=Gold, SS=Stainless Steel, A=Alballoy **VSWR spec based on 3 foot cable with a connector pair



Y1720



HX-4



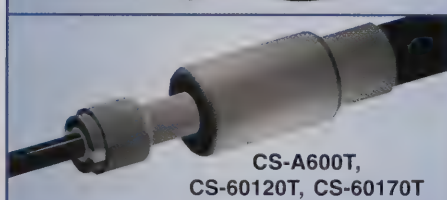
CCT-01

Install Tools

Type	Part Number	Stock Code	Description
Crimp Tool	HX-4	3190-200	Crimp Handle
Crimp Dies	Y1720	3190-203	.610" Hex Dies
Cutting Tool	CCT-01	3190-1544	Cable end flush cut tool
Replacement Blades	RB-01	3190-1609	Replacement blades for cutting tool



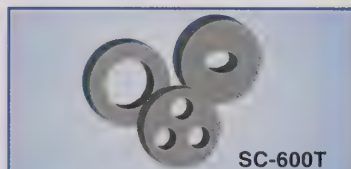
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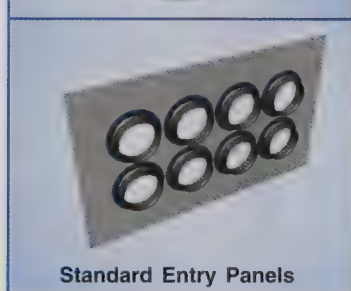
CS-A600T,
CS-60120T, CS-60170T



Hanger Block Supporting Hardware



SC-600T



Standard Entry Panels



HG-600T



CB-600T

Accessories

Type	Part Number	Stock Code	Description
Ground Kit	GK-S600T	GK-S600T	Standard Grounding Kit (each)
Hoisting Grip	HG-600T	HG-600T	Split/Laced Type (each)
Cold Shrink	CS-A600T	CS-A600T	Cable to Antenna Junction (each)
Cold Shrink	CS-60120T	CS-60120T	LMR-600 to -1200 Junction (each)
Cold Shrink	CS-60170T	CS-60170T	LMR-600 to -1700 Junction (each)
Standard Entry Port Cushion	SC-600T	SC-600T	Three Cables (each)
Standard Entry Panels	Full Range of Port Styles/Combinations Available		
Hanger Blocks	CB-600T	CB-600T	Dual Cable Support Block (kit of 10)
Hanger Block Supporting Hardware	Complete Range of Supporting Hardware & Adapters Available		

TIMES MICROWAVE SYSTEMS

A Smiths Group plc company

LMR-195-LLPL

Flexible Low Loss Plenum Coax

Ideal for...

- Indoor Plenum Feeder runs
- UL/NEC/CSA rated CMP/MPP/FT6
- Any wireless application (e.g. LMDS, MMDS, WLL, GPS, LMR, Cellular, PCS, Paging) requiring an easily routed, low loss RF cable for in-building systems

• **LMR®-LLPL** is an indoor highly fire retarded cable intended specifically for runs within return air handling plenums (e.g. dropped ceilings, raised floors). It has a UL/NEC & CSA rating of 'CMP/MPP' and 'FT6' respectively.

• **Flexibility** and bendability are hallmarks of the LMR-195-LLPL cable design. The flexible outer conductor enables the tightest bend radius available for any cable of similar size and performance.

• **Low Loss** is another hallmark feature of LMR-195-LLPL. Size for size LMR has the lowest loss of any flexible cable and comparable loss to semirigid hard-line cables.

• **RF Shielding** is 50 dB greater than typical single shielded coax (40 dB). The multi-ply bonded foil outer conductor is rated conservatively at > 90 dB (i.e. >180 dB between two adjacent cables).

• **Weatherability:** LMR-195-LLPL cables are designed for indoor Plenum applications. Black jacketed LMR-LLPL versions can be supplied for applications that originate outdoors (e.g., rooftop) and subsequently enter the building.

• **Connectors:** A variety of connectors are available for LMR-195-LLPL cable, including the most common interface types. Most employ crimp outer attachment using standard hex crimp sizes.

• **Cable Assemblies:** All LMR-195-LLPL cable types are available as pre-terminated cable assemblies. Refer to the section on FlexTech for further details.



Construction Specifications

Description	Material	In.	(mm)
Inner Conductor	Solid BC	0.037	(0.94)
Dielectric	Low density PTFE	0.113	(2.87)
Outer Conductor	Aluminum Tape	0.119	(3.02)
Overall Braid	Tinned Copper	0.142	(3.61)
Jacket	Orange FRPVC	0.195	(4.95)

Mechanical Specifications

Performance Property	Units	US	(metric)
Bend Radius: installation	in. (mm)	0.5	(12.7)
Bend Radius: repeated	in. (mm)	2.0	(50.8)
Bending Moment	ft-lb (N-m)	0.1	(0.14)
Weight	lb/ft (kg/m)	0.021	(0.03)
Tensile Strength	lb (kg)	40	(18.2)
Flat Plate Crush	lb/in. (kg/mm)	10	(0.18)

Environmental Specifications

Performance Property	°F	°C
Installation Temperature Range	-23/+167	-5/+75
Storage Temperature Range	-23/+167	-5/+75
Operating Temperature Range	-23/+167	-5/+75

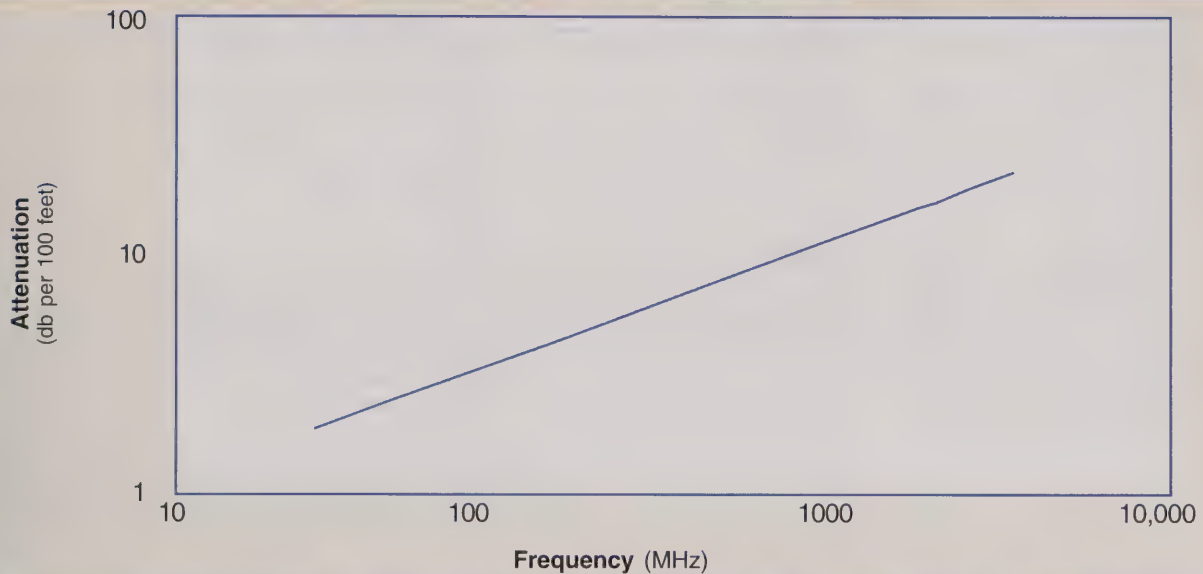
Electrical Specifications

Performance Property	Units	US	(metric)
Cutoff Frequency	GHz	36	
Velocity of Propagation	%	76	
Dielectric Constant	NA	1.73	
Time Delay	nS/ft (nS/m)	1.34	(4.40)
Impedance	ohms	50	
Capacitance	pF/ft (pF/m)	26.7	(87.6)
Inductance	uH/ft (uH/m)	0.067	(0.22)
Shielding Effectiveness	dB	>90	
DC Resistance			
Inner Conductor	ohms/1000ft (/km)	9.5	(31.2)
Outer Conductor	ohms/1000ft (/km)	4.9	(16.1)
Voltage Withstand	Volts DC	1000	
Jacket Spark	Volts RMS	3000	
Peak Power	kW	2.5	

Part Description

Part No.	Application	Jacket	Color	Stock Code
LMR-195-LLPL	Indoor Plenum 'CMP'	FRPVC	Orange	54211

Attenuation vs. Frequency (typical)



Frequency (MHz)	30	50	150	220	450	900	1500	1800	2000	2500	3400	5800
Attenuation dB/100 ft	2.0	2.5	4.4	5.3	7.8	10.9	14.1	15.4	16.3	18.3	21.4	28.2
Attenuation dB/100 m	6.4	8.3	14.4	17.5	25.1	35.6	46.2	50.7	53.5	60.0	70.2	92.5
Avg. Power kW	0.70	0.54	0.31	0.26	0.18	0.12	0.10	0.09	0.08	0.07	0.06	0.05

Calculate Attenuation =

$(0.356297) \cdot \sqrt{\text{FMHz}} + (0.00183) \cdot \text{FMHz}$ (interactive calculator available at <http://www.timesmicrowave/telecom>)

Attenuation:

VSWR=1.0 ; Ambient = +25°C (77°F)

Power:

VSWR=1.0; Ambient = +40°C; Inner Conductor = 100°C (212°F); Sea Level; dry air; atmospheric pressure; no solar loading



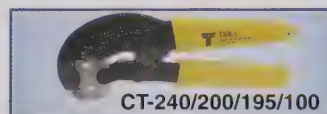
Connectors

Interface	Description	Part Number	Stock Code	VSWR** Freq. (GHz)	Coupling Nut	Inner Contact Attach	Outer Contact Attach	Finish* Body /Pin	Length in (mm)	Width in (mm)	Weight lb (g)
N male	Straight Plug	TC-195-NM	3190-1555	<1.25:1 (2.5)	Knurl	Solder	Crimp	S/G	1.5 (38.1)	0.75 (19.1)	0.073 (33.1)
SMA male	Straight Plug	TC-195-SM	3190-1553	<1.25:1 (2.5)	Hex	Solder	Crimp	SS/G	1.0 (25.4)	0.32 (8.1)	0.015 (6.8)
TNC male	Straight Plug	TC-195-TM	3190-1554	<1.25:1 (2.5)	Knurl	Solder	Crimp	S/G	1.4 (35.6)	0.59 (15.0)	0.045 (20.4)

* Finish metals: N=Nickel, S=Silver, G=Gold, SS=Stainless Steel, A=Alballoy **VSWR spec based on 3 foot cable with a connector pair

Install Tools

Type	Part Number	Stock Code	Description
Crimp Tool	CT-240/200/195/100	3190-667	Crimp tool for LMR 195 connectors
Cutting Tool	CCT-01	3190-1544	Cable end flush cut tool
Replacement Blades	RB-01	3190-1609	Replacement blades for cutting tool



TIMES MICROWAVE SYSTEMS

A Smiths Group plc company

LMR-200-LLPL Flexible Low Loss Plenum Coax

Ideal for...

- Indoor Plenum Feeder runs
- UL/NEC/CSA rated CMP/MPP/FT6
- Any wireless application (e.g. LMDS, MMDS, WLL, GPS, LMR, Cellular, PCS, Paging) requiring an easily routed, low loss RF cable for in-building systems
- **LMR® - LLPL** is an indoor highly fire retarded cable intended specifically for runs within return air handling plenums (e.g. dropped ceilings, raised floors). It has a UL/NEC & CSA rating of 'CMP/MPP' and 'FT6' respectively.
- **Flexibility** and bendability are hallmarks of the LMR-200-LLPL cable design. The flexible outer conductor enables the tightest bend radius available for any cable of similar size and performance.
- **Low Loss** is another hallmark feature of LMR-200-LLPL. Size for size LMR has the lowest loss of any flexible cable and comparable loss to semirigid hard-line cables.
- **RF Shielding** is 50 dB greater than typical single shielded coax (40 dB). The multi-ply bonded foil outer conductor is rated conservatively at > 90 dB (i.e. >180 dB between two adjacent cables).
- **Weatherability:** LMR-200-LLPL cables are designed for indoor Plenum applications. Black jacketed LMR-LLPL versions can be supplied for applications that originate outdoors (e.g., rooftop) and subsequently enter the building.
- **Connectors:** A variety of connectors are available for LMR-200-LLPL cable, including the most common interface types. Most employ crimp outer attachment using standard hex crimp sizes.
- **Cable Assemblies:** All LMR-200-LLPL cable types are available as pre-terminated cable assemblies. Refer to the section on FlexTech for further details.



Construction Specifications

Description	Material	In.	(mm)
Inner Conductor	Solid Bare Copper	0.040	(1.02)
Dielectric	Low density PTFE	0.118	(3.00)
Outer Conductor	Aluminum Tape	0.123	(3.12)
Overall Braid	Tinned Copper	0.146	(3.71)
Jacket	Orange FRPVC	0.195	(4.95)

Mechanical Specifications

Performance Property	Units	US	(metric)
Bend Radius: installation	in. (mm)	0.5	(12.7)
Bend Radius: repeated	in. (mm)	2.0	(50.8)
Bending Moment	ft-lb (N-m)	0.2	(0.27)
Weight	lb/ft (kg/m)	0.032	(0.05)
Tensile Strength	lb (kg)	30	(13.6)
Flat Plate Crush	lb/in. (kg/mm)	65	(1.16)

Environmental Specifications

Performance Property	°F	°C
Installation Temperature Range	-23/+167	-5/+75
Storage Temperature Range	-23/+167	-5/+75
Operating Temperature Range	-23/+167	-5/+75

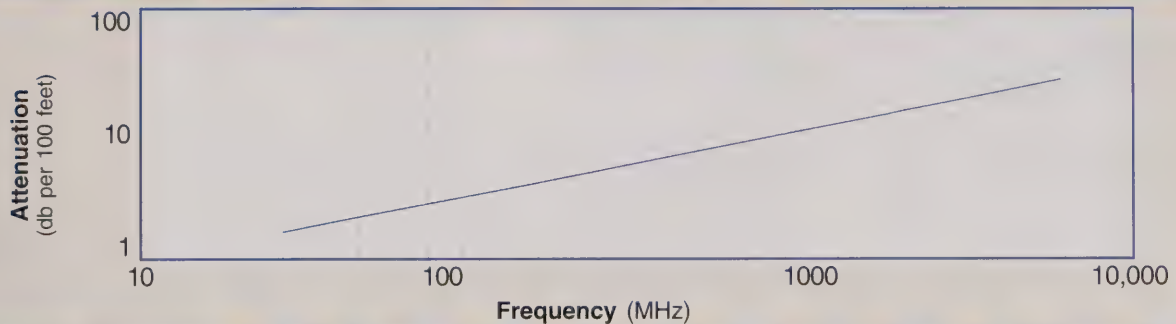
Electrical Specifications

Performance Property	Units	US	(metric)
Cutoff Frequency	GHz	36	
Velocity of Propagation	%	76	
Dielectric Constant	NA	1.73	
Time Delay	nS/ft (nS/m)	1.34	(4.40)
Impedance	ohms	50	
Capacitance	pF/ft (pF/m)	26.7	(87.6)
Inductance	uH/ft (uH/m)	0.067	(0.22)
Shielding Effectiveness	dB	>90	
DC Resistance			
Inner Conductor	ohms/1000ft (/km)	6.5	(21.3)
Outer Conductor	ohms/1000ft (/km)	4.9	(16.1)
Voltage Withstand	Volts DC	1000	
Jacket Spark	Volts RMS	3000	
Peak Power	kW	2.5	

Part Description

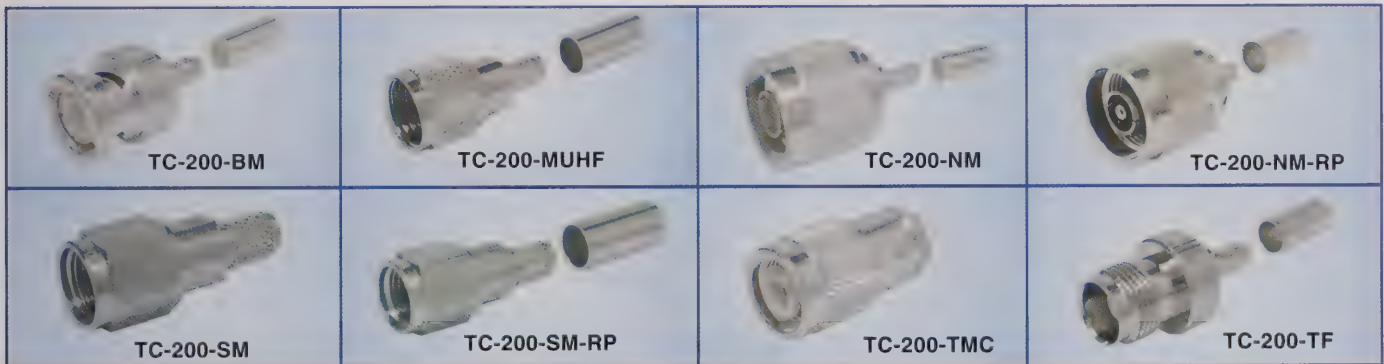
Part No.	Application	Jacket	Color	Stock Code
LMR-200-LLPL	Indoor Plenum CMP/FT6	FRPVC	Orange	54058

Attenuation vs. Frequency (typical)



Frequency (MHz)	30	50	150	220	450	900	1500	1800	2000	2500	3400	5800
Attenuation dB/100 ft	1.8	2.3	4.1	4.9	7.1	10.0	13.0	14.3	15.1	16.0	19.8	26.1
Attenuation dB/100 m	5.9	7.7	13.3	16.1	23.2	32.9	42.7	48.9	49.5	55.5	65.0	85.7
Avg. Power kW	0.77	0.59	0.34	0.28	0.19	0.14	0.11	0.10	0.09	0.08	0.07	0.05

Calculate Attenuation = $(0.329080) \cdot \sqrt{\text{FMHz}} + (0.00018) \cdot \text{FMHz}$ (interactive calculator available at <http://www.timesmicrowave/telecom>)
 Attenuation: VSWR=1.0; Ambient = +25°C (77°F) Power: VSWR=1.0; Ambient = +40°C; Inner Conductor = 100°C (212°F);
 Sea Level; dry air; atmospheric pressure; no solar loading



Connectors

Interface	Description	Part Number	Stock Code	VSWR** Freq. (GHz)	Coupling Nut	Inner Contact Attach	Outer Contact Attach	Finish* Body /Pin	Length in (mm)	Width in (mm)	Weight lb (g)
N Male	Straight Plug	TC-200-NM	3190-224	<1.25:1 (2.5)	Knurl	Solder	Crimp	S/G	1.5 (38.1)	0.75 (19.1)	0.073 (33.1)
	Reverse Polarity	TC-200-NM-RP	3190-959	<1.25:1 (2.5)	Knurl	Solder	Crimp	NG	1.5 (38.0)	0.75 (19.1)	0.073 (33.1)
BNC Male	Straight Plug	TC-200-BM	3190-225	<1.25:1 (2.5)	Knurl	Solder	Crimp	S/G	1.7 (43.2)	0.56 (14.2)	0.045 (20.4)
TNC Male	Straight Plug	TC-200-TMC	3190-240	<1.25:1 (2.5)	Knurl	Solder	Clamp	S/G	1.7 (43.2)	0.59 (15.0)	0.045 (20.4)
TNC Female	Straight Jack	TC-200-TF	3190-263	<1.25:1 (2.5)	NA	Solder	Crimp	NG	1.3 (33.0)	0.57 (14.5)	0.033 (15.0)
SMA-Male	Straight plug	TC-200-SM	3190-612	<1.25:1 (8)	Hex	Solder	Crimp	SS/G	1.0 (25.4)	0.32 (8.1)	0.015 (6.8)
SMA-Rev. Polarity	Straight Plug	TC-200-SM-RP	3190-327	<1.25:1 (2.5)	Hex	Solder	Crimp	SS/G	1.0 (25.4)	0.32 (8.1)	0.015 (6.8)
Mini-UHF	Straight Plug	TC-200-MUHF	3190-444	<1.25:1 (2.5)	Knurl	Solder	Crimp	NG	1.1 (27.9)	0.45 (11.4)	0.015 (6.8)

* Finish metals: N=Nickel, S=Silver, G=Gold, SS=Stainless Steel, A=Alballoy **VSWR spec based on 3 foot cable with a connector pair

Hardware Accessories

Type	Part Number	Stock Code	Description
Ground Kit	GK-S200T	GK-S200T	Standard Ground Kit (each)



Install Tools

Type	Part Number	Stock Code	Description
Crimp Tool	CT-240/200/195/100	3190-667	Crimp tool for LMR 200 connectors
Cutting Tool	CCT-01	3190-1544	Cable end flush cut tool
Replacement Blades	RB-01	3190-1609	Replacement blades for cutting tool



TIMES MICROWAVE SYSTEMS

A Smiths Group plc company

LMR-240-LLPL Flexible Low Loss Plenum Coax

Ideal for...

- Indoor Plenum Feeder runs
- UL/NEC/CSA rated CMP/MPP/FT6
- Any wireless application (e.g. LMDS, MMDS, WLL, GPS, LMR, Cellular, PCS, Paging) requiring an easily routed, low loss RF cable for in-building systems



• **LMR®-LLPL** is an indoor highly fire retarded cable intended specifically for runs within return air handling plenums (e.g. dropped ceilings, raised floors). It has a UL/NEC & CSA rating of 'CMP/MPP' and 'FT6' respectively.

• **Flexibility** and bendability are hallmarks of the LMR-240-LLPL cable design. The flexible outer conductor enables the tightest bend radius available for any cable of similar size and performance.

• **Low Loss** is another hallmark feature of LMR-240-LLPL. Size for size LMR has the lowest loss of any flexible cable and comparable loss to semirigid hard-line cables.

• **RF Shielding** is 50 dB greater than typical single shielded coax (40 dB). The multi-ply bonded foil outer conductor is rated conservatively at > 90 dB (i.e. >180 dB between two adjacent cables).

• **Weatherability:** LMR-240-LLPL cables are designed for indoor Plenum applications. Black jacketed LMR-LLPL versions can be supplied for applications that originate outdoors (e.g., rooftop) and subsequently enter the building.

• **Connectors:** A variety of connectors are available for LMR-240-LLPL cable, including the most common interface types. Most employ crimp outer attachment using standard hex crimp sizes.

• **Cable Assemblies:** All LMR-240-LLPL cable types are available as pre-terminated cable assemblies. Refer to the section on FlexTech for further details.

Part Description				
Part No.	Application	Jacket	Color	Stock Code
LMR-240-LLPL	Indoor Plenum CMP/FT6	FRPVC	Orange	54059

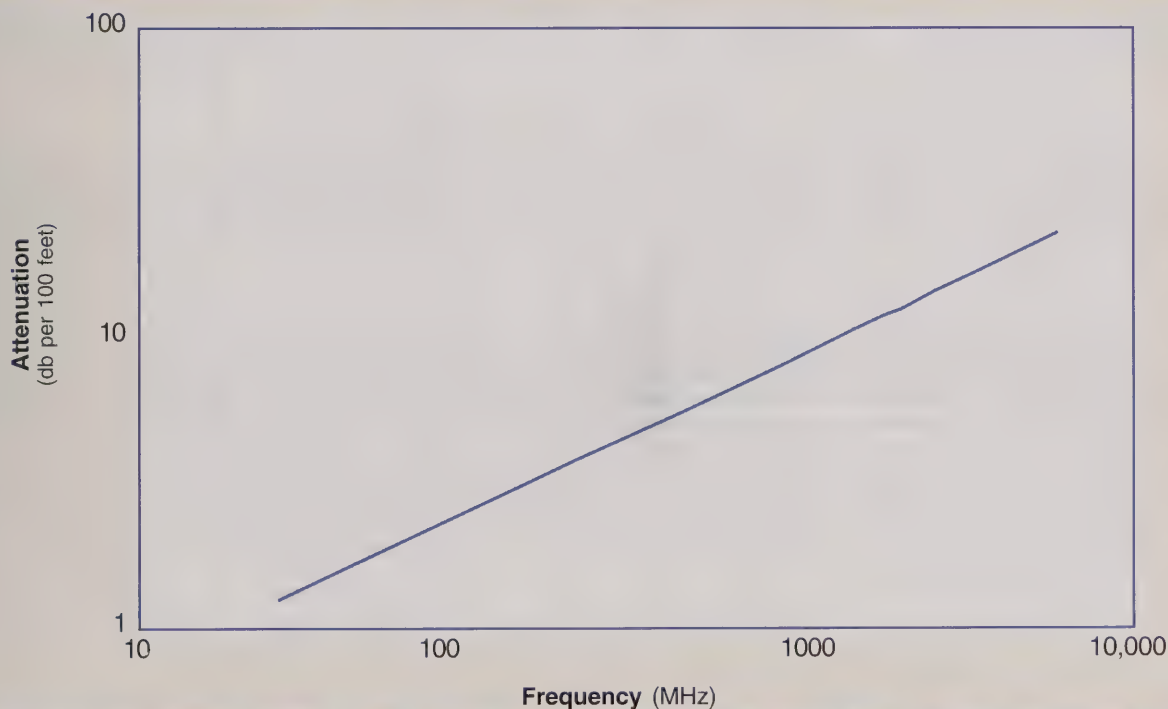
Construction Specifications				
Description	Material	In.	(mm)	
Inner Conductor	Solid Bare Copper	0.051	(1.30)	
Dielectric	Low density PTFE	0.150	(3.81)	
Outer Conductor	Aluminum Tape	0.155	(3.94)	
Overall Braid	Tinned Copper	0.178	(4.52)	
Jacket	Orange FRPVC	0.240	(6.10)	

Mechanical Specifications				
Performance Property	Units	US	(metric)	
Bend Radius: installation	in. (mm)	0.75	(19.1)	
Bend Radius: repeated	in. (mm)	2.5	(63.5)	
Bending Moment	ft-lb (N-m)	0.25	(0.34)	
Weight	lb/ft (kg/m)	0.047	(0.07)	
Tensile Strength	lb (kg)	60	(27.22)	
Flat Plate Crush	lb/in. (kg/mm)	85	(1.52)	

Environmental Specifications				
Performance Property		°F	°C	
Installation Temperature Range		-23/+167	-5/+75	
Storage Temperature Range		-23/+167	-5/+75	
Operating Temperature Range		-23/+167	-5/+75	

Electrical Specifications			
Performance Property	Units	US	(metric)
Cutoff Frequency	GHz	28	
Velocity of Propagation	%	76	
Dielectric Constant	NA	1.73	
Time Delay	nS/ft (nS/m)	1.34	(4.40)
Impedance	ohms	50	
Capacitance	pF/ft (pF/m)	26.7	(87.6)
Inductance	uH/ft (uH/m)	0.067	(0.22)
Shielding Effectiveness	dB	>90	
DC Resistance			
Inner Conductor	ohms/1000ft (/km)	4.0	(13.1)
Outer Conductor	ohms/1000ft (/km)	3.9	(12.8)
Voltage Withstand	Volts DC	1000	
Jacket Spark	Volts RMS	3000	
Peak Power	kW	5.6	

Attenuation vs. Frequency (typical)



Frequency (MHz)	30	50	150	220	450	900	1500	1800	2000	2500	3400	5800
Attenuation dB/100 ft	1.4	1.8	3.1	3.7	5.4	7.6	9.9	10.9	11.5	12.9	15.1	20.0
Attenuation dB/100 m	4.5	5.8	10.1	12.2	17.6	25.0	32.5	35.7	37.7	42.3	49.6	65.6
Avg. Power kW	1.18	0.91	0.52	0.43	0.30	0.21	0.16	0.15	0.14	0.12	0.10	0.08

Calculate Attenuation =

$(0.248520) \cdot \sqrt{\text{FMHz}} + (0.000183) \cdot \text{FMHz}$ (interactive calculator available at <http://www.timesmicrowave/telecom>)

Attenuation:

VSWR=1.0; Ambient = +25°C (77°F)

Power:

VSWR=1.0; Ambient = +40°C; Inner Conductor = 100°C (212°F); Sea Level; dry air; atmospheric pressure; no solar loading

TIMES MICROWAVE SYSTEMS

A Smiths Group plc company

LMR-240-LLPL Flexible Low Loss Plenum Coax



Connectors

Interface	Description	Part Number	Stock Code	VSWR** Freq. (GHz)	Coupling Nut	Inner Contact Attach	Outer Contact Attach	Finish* Body /Pin	Length in (mm)	Width in (mm)	Weight lb (g)
N Male	Straight Plug	TC-240-NM	3190-382	<1.25:1 (2.5)	Hex	Solder	Crimp	NS	1.5 (38)	0.75 (19.1)	0.086 (39.0)
N Male	Straight Plug	TC-240-NMC	3190-244	<1.25:1 (2.5)	Knurl	Solder	Clamp	S/G	1.5 (38)	0.75 (19.1)	0.082 (37.2)
BNC Male	Straight Plug	TC-240-BMC	3190-242	<1.25:1 (2.5)	Knurl	Solder	Clamp	S/G	1.7 (43)	0.56 (14.2)	0.040 (18.1)
TNC Male	Straight Plug	TC-240-TM	3190-275	<1.25:1 (2.5)	Knurl	Solder	Crimp	NS	1.7 (43)	0.59 (15.0)	0.043 (19.5)
TNC Male	Right Angle	TC-240-TM-RA	3190-604	<1.35:1 (2.5)	Knurl	Solder	Crimp	NG	1.3 (33)	0.57 (14.5)	0.055 (24.9)
SMA Male	Straight Plug	TC-240-SM	3190-380	<1.25:1 (10)	Hex	Solder	Crimp	SS/G	1.0 (25)	0.32 (8.1)	0.016 (7.3)
SMA Male	Right Angle	TC-240-SM-RA	3190-381	<1.35:1 (6)	Hex	Solder	Crimp	SS/G	0.8 (20)	0.65 (16.5)	0.019 (8.6)
SMA Female	Bulkhead Jack	TC-240-SF-BH	3190-824	<1.25:1 (2.5)	NA	Solder	Crimp	SS/G	1.1 (29)	0.31 (7.9)	0.019 (8.6)
SMA Rev. Polarity	Straight Plug	TC-240-SM-RP	3190-326	<1.25:1 (2.5)	Hex	Solder	Crimp	SS/G	1.0 (25)	0.32 (8.1)	0.016 (7.3)
Mini-UHF	Straight Plug	TC-240-MUHF	3190-445	<1.25:1 (2.5)	Knurl	Solder	Crimp	NG	1.1 (28)	0.45 (11.4)	0.014 (6.4)

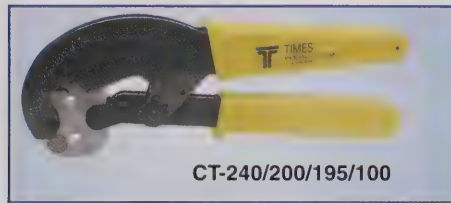
* Finish metals: N=Nickel, S=Silver, G=Gold, SS=Stainless Steel, A=Alballoy **VSWR spec based on 3 foot cable with a connector pair



GK-S240T

Hardware Accessories

Type	Part Number	Stock Code	Description
Ground Kit	GK-S240T	GK-S240T	Standard Ground Kit (each)



CT-240/200/195/100



CCT-01

Install Tools

Type	Part Number	Stock Code	Description
Crimp Tool	CT-240/200/195/100	3190-667	Crimp tool for LMR-240 connectors
Cutting Tool	CCT-01	3190-1544	Cable end flush cut tool
Replacement Blades	RB-01	3190-1609	Replacement blades for cutting tool

TIMES MICROWAVE SYSTEMS

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LMR-300-LLPL Flexible Low Loss Plenum Coax

Ideal for...

- Indoor Plenum Feeder runs
- UL/NEC/CSA rated CMP/MPP/FT6
- Any wireless application (e.g. LMDS, MMDS, WLL, GPS, LMR, Cellular, PCS, Paging) requiring an easily routed, low loss RF cable for in-building systems
- **LMR®-LLPL** is an indoor highly fire retarded cable intended specifically for runs within return air handling plenums (e.g. dropped ceilings, raised floors). It has a UL/NEC & CSA rating of 'CMP/MPP' and 'FT6' respectively.
- **Flexibility** and bendability are hallmarks of the LMR-300-LLPL cable design. The flexible outer conductor enables the tightest bend radius available for any cable of similar size and performance.
- **Low Loss** is another hallmark feature of LMR-300-LLPL. Size for size LMR has the lowest loss of any flexible cable and comparable loss to semirigid hard-line cables.
- **RF Shielding** is 50 dB greater than typical single shielded coax (40 dB). The multi-ply bonded foil outer conductor is rated conservatively at > 90 dB (i.e. >180 dB between two adjacent cables).
- **Weatherability:** LMR-300-LLPL cables are designed for indoor Plenum applications. Black jacketed LMR-LLPL versions can be supplied for applications that originate outdoors (e.g., rooftop) and subsequently enter the building.
- **Connectors:** A variety of connectors are available for LMR-300-LLPL cable, including the most common interface types. Most employ crimp outer attachment using standard hex crimp sizes.
- **Cable Assemblies:** All LMR-300-LLPL cable types are available as pre-terminated cable assemblies. Refer to the section on FlexTech for further details.



Construction Specifications				
Description	Material	In.	(mm)	
Inner Conductor	Solid Bare Copper	0.063	(1.60)	
Dielectric	Low density PTFE	0.190	(4.83)	
Outer Conductor	Aluminum Tape	0.196	(4.98)	
Overall Braid	Tinned Copper	0.225	(5.72)	
Jacket	Orange FRPVC	0.300	(7.62)	

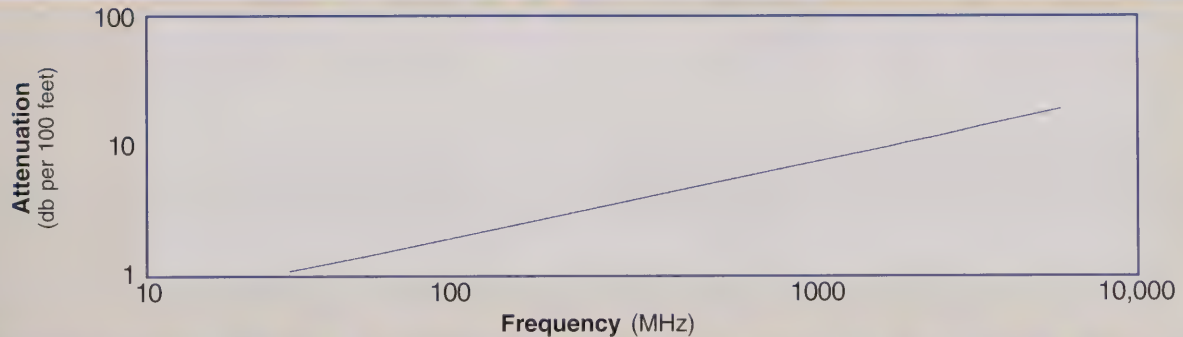
Mechanical Specifications				
Performance Property	Units	US	(metric)	
Bend Radius: installation	in. (mm)	0.875	(22.2)	
Bend Radius: repeated	in. (mm)	3.0	(76.2)	
Bending Moment	ft-lb (N-m)	0.38	(0.52)	
Weight	lb/ft (kg/m)	0.055	(0.08)	
Tensile Strength	lb (kg)	120	(54.5)	
Flat Plate Crush	lb/in. (kg/mm)	30	(0.54)	

Environmental Specifications				
Performance Property	°F	°C		
Installation Temperature Range	-23/+167	-5/+75		
Storage Temperature Range	-23/+167	-5/+75		
Operating Temperature Range	-23/+167	-5/+75		

Electrical Specifications				
Performance Property		Units	US	(metric)
Cutoff Frequency		GHz		23
Velocity of Propagation		%		76
Dielectric Constant		NA		1.73
Time Delay	nS/ft (nS/m)		1.34	(4.40)
Impedance	ohms			50
Capacitance	pF/ft (pF/m)		26.7	(87.6)
Inductance	uH/ft (uH/m)		0.067	(0.22)
Shielding Effectiveness		dB		>90
DC Resistance				
Inner Conductor	ohms/1000ft (/km)		2.6	(8.6)
Outer Conductor	ohms/1000ft (/km)		2.2	(7.3)
Voltage Withstand		Volts DC		2000
Jacket Spark		Volts RMS		5000
Peak Power		kW		10

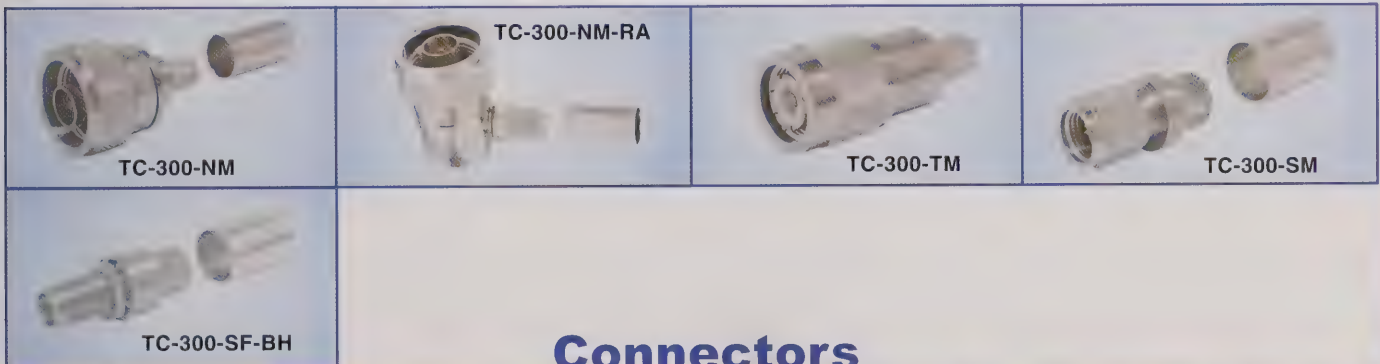
Part Description				
Part No.	Application	Jacket	Color	Stock Code
LMR-300-LLPL	Indoor Plenum CMP/FT6	FRPVC	Orange	54175

Attenuation vs. Frequency (typical)



Frequency (MHz)	30	50	150	220	450	900	1500	1800	2000	2500	3400	5800
Attenuation dB/100 ft	1.1	1.4	2.5	3.0	4.3	6.2	8.1	8.9	9.4	10.5	12.3	16.4
Attenuation dB/100 m	3.6	4.7	8.2	9.9	14.3	20.3	26.4	29.1	30.7	34.5	40.5	53.7
Avg. Power kW	1.72	1.33	0.77	0.63	0.44	0.31	0.24	0.21	0.20	0.18	0.15	0.11

Calculate Attenuation = $(0.200950) \cdot \sqrt{\text{FMHz}} + (0.000183) \cdot \text{FMHz}$ (interactive calculator available at <http://www.timesmicrowave/telecom>)
 Attenuation: VSWR=1.0; Ambient = +25°C (77°F) Power: VSWR=1.0; Ambient = +40°C; Inner Conductor = 100°C (212°F);
 Sea Level; dry air; atmospheric pressure; no solar loading



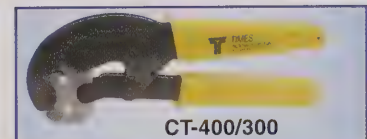
Connectors

Interface	Description	Part Number	Stock Code	VSWR Freq. (GHz)	Coupling Nut	Inner Contact Attach	Outer Contact Attach	Finish* Body /Pin	Length in (mm)	Width in (mm)	Weight lb (g)
N Male	Straight Plug	TC-300-NM	3190-498	<1.25:1 (6)	Knurl	Solder	Crimp	NS	1.6 (41)	0.85 (21.6)	0.074 (33.8)
N Male	Right Angle	TC-300-NM-RA	3190-499	<1.35:1 (2.5)	Knurl	Solder	Crimp	NS	1.5 (38)	0.85 (21.6)	0.101 (45.8)
TNC Male	Straight Plug	TC-300-TM	3190-500	<1.25:1 (2.5)	Knurl	Solder	Crimp	NS	1.7 (43)	0.59 (15.0)	0.050 (22.7)
SMA Male	Straight Plug	TC-300-SM	3190-501	<1.25:1 (2.5)	Hex	Solder	Crimp	SS/G	1.0 (25)	0.35 (8.9)	0.018 (8.2)
SMA Female	Bulkhead Jack	TC-300-SF-BH	3190-500	<1.25:1 (2.5)	NA	Solder	Crimp	SS/G	1.1 (28)	0.31 (7.9)	0.022 (10.0)

* Finish metals: N=Nickel, S=Silver, G=Gold, SS=Stainless Steel, A=Alballoy **VSWR spec based on 3 foot cable with a connector pair

Hardware Accessories

Type	Part Number	Stock Code	Description
Ground Kit	GK-S300T	GK-S300T	Standard Ground Kit (each)



Install Tools

Type	Part Number	Stock Code	Description
Crimp Tool	CT-400/300	3190-666	Crimp tool for LMR 300 connectors
Cutting Tool	CCT-01	3190-1544	Cable end flush cut tool
Replacement Blades	RB-01	3190-1609	Replacement blades for cutting tool



TIMES MICROWAVE SYSTEMS

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LMR-400-LLPL

Flexible Low Loss Plenum Coax

Ideal for...

- Indoor Plenum Feeder runs
- UL/NEC/CSA rated CMP/MPP/FT6
- Any wireless application (e.g. LMDS, MMDS, WLL, GPS, LMR, Cellular, PCS, Paging) requiring an easily routed, low loss RF cable for in-building systems



• **LMR®-LLPL** is an indoor highly fire retarded cable intended specifically for runs within return air handling plenums (e.g. dropped ceilings, raised floors). It has a UL/NEC & CSA rating of 'CMP/MPP' and 'FT6' respectively.

• **Flexibility** and bendability are hallmarks of the LMR-400-LLPL cable design. The flexible outer conductor enables the tightest bend radius available for any cable of similar size and performance.

• **Low Loss** is another hallmark feature of LMR-400-LLPL. Size for size LMR has the lowest loss of any flexible cable and comparable loss to semirigid hard-line cables.

• **RF Shielding** is 50 dB greater than typical single shielded coax (40 dB). The multi-ply bonded foil outer conductor is rated conservatively at > 90 dB (i.e. >180 dB between two adjacent cables).

• **Weatherability:** LMR-400-LLPL cables are designed for indoor Plenum applications. Black jacketed LMR-LLPL versions can be supplied for applications that

originate outdoors (e.g., rooftop) and subsequently enter the building.

• **Connectors:** A variety of connectors are available for LMR-400-LLPL cable, including the most common interface types. Most employ crimp outer attachment using standard hex crimp sizes.

• **Cable Assemblies:** All LMR-400-LLPL cable types are available as pre-terminated cable assemblies. Refer to the section on FlexTech for further details.

Part Description				
Part No.	Application	Jacket	Color	Stock Code
LMR-400-LLPL	Indoor Plenum CMP/FT6	FRPVC	Orange	54070

Construction Specifications				
Description	Material	In.	(mm)	
Inner Conductor	Solid BCCAI	0.095	(2.41)	
Dielectric	Low density PTFE	0.285	(7.24)	
Outer Conductor	Aluminum Tape	0.291	(7.39)	
Overall Braid	Tinned Copper	0.320	(8.13)	
Jacket	Orange FRPVC	0.405	(10.29)	

Mechanical Specifications

Performance Property	Units	US	(metric)
Bend Radius: installation	in. (mm)	1.0	(25.4)
Bend Radius: repeated	in. (mm)	4.0	(101.6)
Bending Moment	ft-lb (N-m)	1.0	(1.36)
Weight	lb/ft (kg/m)	0.114	(0.17)
Tensile Strength	lb (kg)	120	(54.5)
Flat Plate Crush	lb/in. (kg/mm)	185	(3.31)

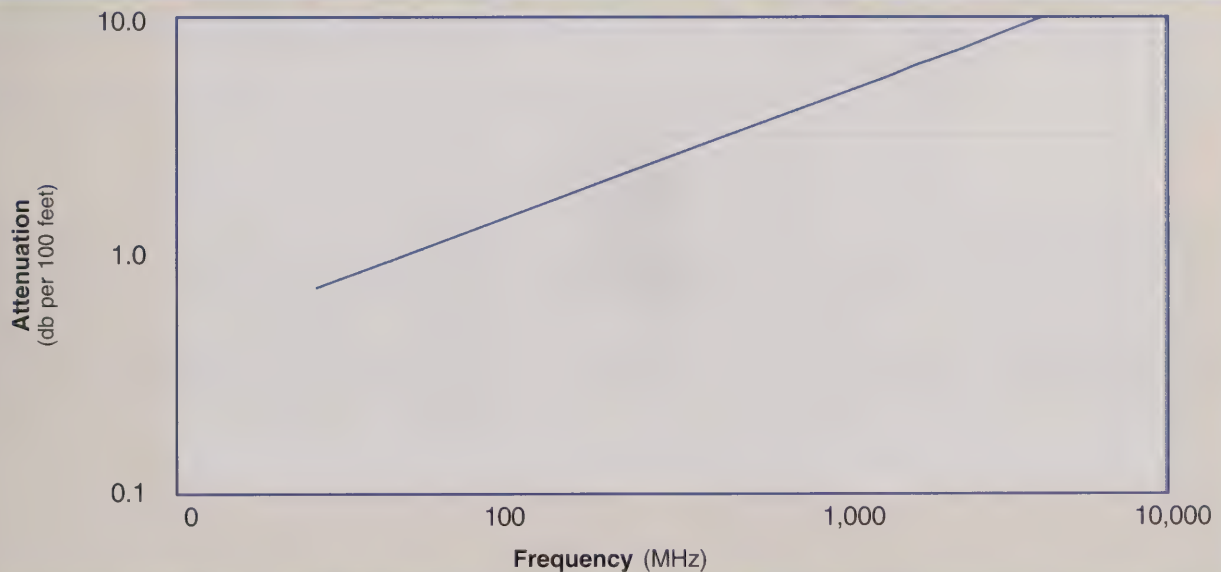
Environmental Specifications

Performance Property	°F	°C
Installation Temperature Range	-23/+167	-5/+75
Storage Temperature Range	-23/+167	-5/+75
Operating Temperature Range	-23/+167	-5/+75

Electrical Specifications

Performance Property	Units	US	(metric)
Cutoff Frequency	GHz	15	
Velocity of Propagation	%	76	
Dielectric Constant	NA	1.73	
Time Delay	nS/ft (nS/m)	1.34	(4.40)
Impedance	ohms	50	
Capacitance	pF/ft (pF/m)	26.7	(87.6)
Inductance	uH/ft (uH/m)	0.067	(0.22)
Shielding Effectiveness	dB	>90	
DC Resistance			
Inner Conductor	ohms/1000ft (/km)	1.8	(5.9)
Outer Conductor	ohms/1000ft (/km)	1.65	(5.4)
Voltage Withstand	Volts DC	2500	
Jacket Spark	Volts RMS	8000	
Peak Power	kW	16	

Attenuation vs. Frequency (typical)



Frequency (MHz)	30	50	150	220	450	900	1500	1800	2000	2500	3400	5800
Attenuation dB/100 ft	0.7	0.9	1.6	1.9	2.8	4.0	5.2	5.7	6.1	6.8	8.0	10.7
Attenuation dB/100 m	2.3	3.0	5.3	6.4	9.2	13.2	17.1	18.9	19.9	22.4	26.4	35.1
Avg. Power kW	3.33	2.57	1.48	1.22	0.84	0.59	0.45	0.41	0.39	0.34	0.29	0.22

Calculate Attenuation =

$(0.129140) \cdot \sqrt{\text{FMHz}} + (0.000150) \cdot \text{FMHz}$ (interactive calculator available at <http://www.timesmicrowave/telecom>)

Attenuation:

VSWR=1.0 ; Ambient = +25°C (77°F)

Power:

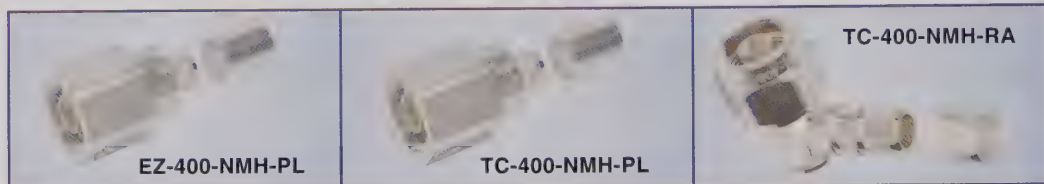
VSWR=1.0; Ambient = +40°C; Inner Conductor = 100°C (212°F); Sea Level; dry air; atmospheric pressure; no solar loading

TIMES MICROWAVE SYSTEMS

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LMR-400-LLPL

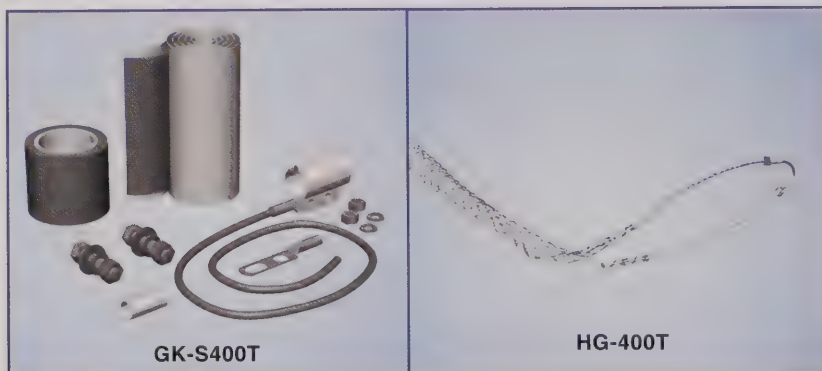
Flexible Low Loss Plenum Coax



Connectors

Interface	Description	Part Number	Stock Code	VSWR** Freq. (GHz)	Coupling Nut	Inner Contact Attach	Outer Contact Attach	Finish* Body /Pin	Length in (mm)	Width in (mm)	Weight lb (g)
N Male	Straight Plug	EZ-400-NMH-PL	3190-602	<1.25:1 (2.5)	Hex	Spring Finger	Clamp	S/G	1.5 (38)	0.89 (22.6)	0.113 (51.3)
	Straight Plug	TC-400-NMH-PL	3190-759	<1.25:1 (2.5)	Hex	Solder	Crimp	S/G	1.5 (38)	0.89 (22.6)	0.113 (51.3)
	Right Angle	TC-400-NMH-RA	3190-422	<1.35:1 (6)	Hex	Solder	Crimp	S/G	1.8 (46)	1.25 (31.8)	0.130 (59.0)

* Finish metals: N=Nickel, S=Silver, G=Gold, SS=Stainless Steel, A=Alballoy **VSWR spec based on 3 foot cable with a connector pair



Hardware Accessories

Type	Part Number	Stock Code	Description
Ground Kit	GK-S400T	GK-S400T	Standard Grounding Kit (each)
Hoisting Grip	HG-400T	HG-400T	Laced Type (each)



Install Tools

Type	Part Number	Stock Code	Description
Crimp Tool	HX-4	3190-200	Crimp Handle
Crimp Dies	Y1719	3190-202	.429" Hex Dies
Crimp Tool	CT-400/300	3190-666	Crimp tool for LMR 400 connectors
Crimp Rings	CR-400	3190-830	Crimp rings for TC/EZ-400 connectors (package of 10)
Strip Tool	ST-400C	3190-228	For Clamp Connectors
Strip Tool	ST-400EZ	3190-401	For Crimp Connectors
Deburr Tool	DBT-01	3190-406	Removes center conductor rough edges
Cutting Tool	CCT-01	3190-1544	Cable end flush cut tool
Replacement Blades	RB-01	3190-1609	Replacement blades for cutting tool
Tool Kit	TK-400EZ	3190-1602	Tool kit for LMR-400 Crimp Connectors (includes CCT-01, ST-400EZ, CT-400/300, DBT-01, Tool Pouch)

TIMES MICROWAVE SYSTEMS

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LMR-500-LLPL Flexible Low Loss Plenum Coax

Ideal for...

- Indoor Plenum Feeder runs
 - UL/NEC/CSA rated CMP/MPP/FT6
 - Any wireless application (e.g. LMDS, MMDS, WLL, GPS, LMR, Cellular, PCS, Paging) requiring an easily routed, low loss RF cable for in-building systems
- **LMR®-LLPL** is an indoor highly fire retarded cable intended specifically for runs within return air handling plenums (e.g. dropped ceilings, raised floors). It has a UL/NEC & CSA rating of 'CMP/MPP' and 'FT6' respectively.
- **Flexibility** and bendability are hallmarks of the LMR-500-LLPL cable design. The flexible outer conductor enables the tightest bend radius available for any cable of similar size and performance.
- **Low Loss** is another hallmark feature of LMR-500-LLPL. Size for size LMR has the lowest loss of any flexible cable and comparable loss to semirigid hard-line cables.
- **RF Shielding** is 50 dB greater than typical single shielded coax (40 dB). The multi-ply bonded foil outer conductor is rated conservatively at > 90 dB (i.e. >180 dB between two adjacent cables).
- **Weatherability:** LMR-500-LLPL cables are designed for indoor Plenum applications. Black jacketed LMR-LLPL versions can be supplied for applications that originate outdoors (e.g., rooftop) and subsequently enter the building.
- **Connectors:** A variety of connectors are available for LMR-500-LLPL cable, including the most common interface types. Most employ crimp outer attachment using standard hex crimp sizes.
- **Cable Assemblies:** All LMR-500-LLPL cable types are available as pre-terminated cable assemblies. Refer to the section on FlexTech for further details.



Construction Specifications

Description	Material	In.	(mm)
Inner Conductor	Solid BCCAl	0.123	(3.12)
Dielectric	Low density PTFE	0.370	(9.40)
Outer Conductor	Aluminum Tape	0.376	(9.55)
Overall Braid	Tinned Copper	0.405	(10.29)
Jacket	Orange FRPVC	0.500	(12.70)

Mechanical Specifications

Performance Property	Units	US	(metric)
Bend Radius: installation	in. (mm)	1.25	(31.8)
Bend Radius: repeated	in. (mm)	5.0	(127.0)
Bending Moment	ft-lb (N-m)	1.75	(2.37)
Weight	lb/ft (kg/m)	0.194	(0.29)
Tensile Strength	lb (kg)	195	(88.5)
Flat Plate Crush	lb/in. (kg/mm)	200	(3.57)

Environmental Specifications

Performance Property	°F	°C
Installation Temperature Range	-23/+167	-5/+75
Storage Temperature Range	-23/+167	-5/+75
Operating Temperature Range	-23/+167	-5/+75

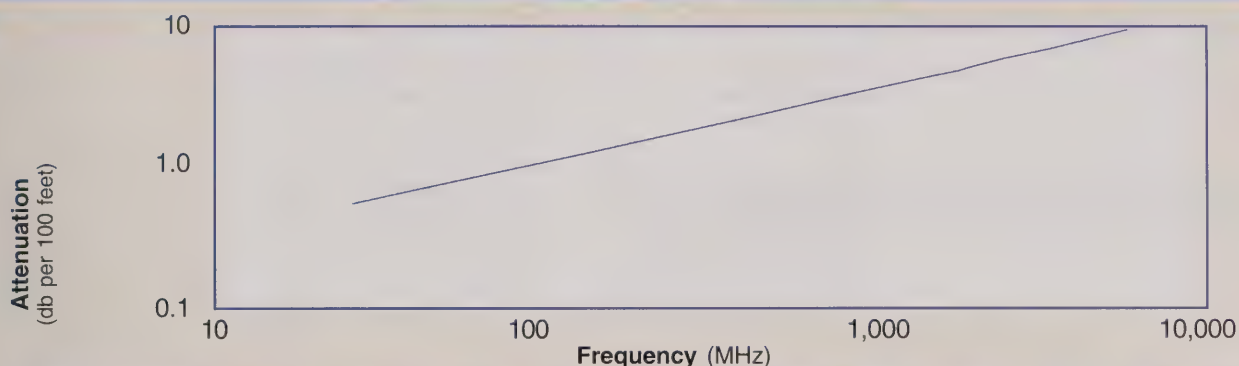
Electrical Specifications

Performance Property	Units	US	(metric)
Cutoff Frequency	GHz	11.6	
Velocity of Propagation	%	76	
Dielectric Constant	NA	1.73	
Time Delay	nS/ft (nS/m)	1.34	(4.40)
Impedance	ohms	50	
Capacitance	pF/ft (pF/m)	26.7	(87.6)
Inductance	uH/ft (uH/m)	0.067	(0.22)
Shielding Effectiveness	dB	>90	
DC Resistance			
Inner Conductor	ohms/1000ft (/km)	1.1	(3.6)
Outer Conductor	ohms/1000ft (/km)	1.27	(4.2)
Voltage Withstand	Volts DC	3000	
Jacket Spark	Volts RMS	8000	
Peak Power	kW	11.6	

Part Description

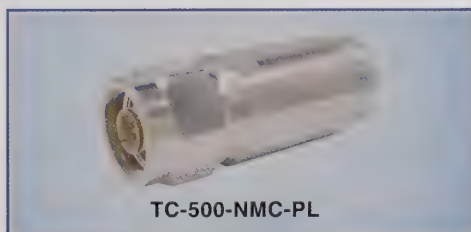
Part No.	Application	Jacket	Color	Stock Code
LMR-500-LLPL	Indoor Plenum CMP/FT6	FRPVC	Orange	54060

Attenuation vs. Frequency (typical)



Frequency (MHz)	30	50	150	220	450	900	1500	1800	2000	2500	3400	5800
Attenuation dB/100 ft	0.6	0.7	1.3	1.5	2.2	3.1	4.1	4.5	4.8	5.4	6.4	8.5
Attenuation dB/100 m	1.8	2.4	4.1	5.0	7.2	10.3	13.5	14.8	15.7	17.7	20.9	27.9
Avg. Power kW	4.99	3.86	2.21	1.82	1.26	0.88	0.67	0.61	0.58	0.51	0.43	0.32

Calculate Attenuation = $(0.100260) \cdot \sqrt{\text{FMHz}} + (0.000150) \cdot \text{FMHz}$ (interactive calculator available at <http://www.timesmicrowave/telecom>)
 Attenuation: VSWR=1.0; Ambient = +25°C (77°F) Power: VSWR=1.0; Ambient = +40°C; Inner Conductor = 100°C (212°F);
 Sea Level; dry air; atmospheric pressure; no solar loading

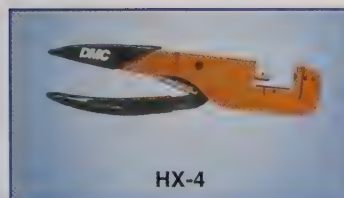


TC-500-NMC-PL

Connectors

Interface	Description	Part Number	Stock Code	VSWR** Freq. (GHz)	Coupling Nut	Inner Contact Attach	Outer Contact Attach	Finish* Body /Pin	Length in (mm)	Width in (mm)	Weight lb (g)
N Male	Straight Plug	TC-500-NMC-PL	3190-900	<1.25:1 (2.5)	Hex	Solder	Clamp	S/G	2.1 (53)	0.92 (23.4)	0.228 (103.4)

* Finish metals: N=Nickel, S=Silver, G=Gold, SS=Stainless Steel, A=Alballoy **VSWR spec based on 3 foot cable with a connector pair



HX-4



Y151



ST-500C



DBT-01

Install Tools

Type	Part Number	Stock Code	Description
Crimp Tool	HX-4	3190-200	Crimp Handle
Crimp Dies	Y151	3190-465	.532" Hex Dies
Strip Tool	ST-500C	3190-229	For Clamp Style Connectors
Deburr Tool	DBT-01	3190-406	Removes center conductor rough edges
Cutting Tool	CCT-01	3190-1544	Cable end flush cut tool
Replacement Blades	RB-01	3190-1609	Replacement blades for cutting tool



CCT-01

TIMES MICROWAVE SYSTEMS

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LMR-600-LLPL Flexible Low Loss Plenum Coax

Ideal for...

- Indoor Plenum Feeder runs
- UL/NEC/CSA rated CMP/MPP/FT6
- Any wireless application (e.g. LMDS, MMDS, WLL, GPS, LMR, Cellular, PCS, Paging) requiring an easily routed, low loss RF cable for in-building systems



• **LMR®-LLPL** is an indoor highly fire retarded cable intended specifically for runs within return air handling plenums (e.g. dropped ceilings, raised floors). It has a UL/NEC & CSA rating of 'CMP/MPP' and 'FT6' respectively.

• **Flexibility** and bendability are hallmarks of the LMR-600-LLPL cable design. The flexible outer conductor enables the tightest bend radius available for any cable of similar size and performance.

• **Low Loss** is another hallmark feature of LMR-600-LLPL. Size for size LMR has the lowest loss of any flexible cable and comparable loss to semirigid hard-line cables.

• **RF Shielding** is 50 dB greater than typical single shielded coax (40 dB). The multi-ply bonded foil outer conductor is rated conservatively at > 90 dB (i.e. >180 dB between two adjacent cables).

• **Weatherability:** LMR-600-LLPL cables are designed for indoor Plenum applications. Black jacketed LMR-LLPL versions can be supplied for applications that originate outdoors (e.g., rooftop) and subsequently enter the building.

• **Connectors:** A variety of connectors are available for LMR-600-LLPL cable, including the most common interface types. Most employ crimp outer attachment using standard hex crimp sizes.

• **Cable Assemblies:** All LMR-600-LLPL cable types are available as pre-terminated cable assemblies. Refer to the section on FlexTech for further details.

Part Description				
Part No.	Application	Jacket	Color	Stock Code
LMR-600-LLPL	Indoor Plenum CMP/FT6	FRPVC	Orange	54061

Construction Specifications			
Description	Material	In.	(mm)
Inner Conductor	Solid BCCAI	0.150	(3.81)
Dielectric	Low density PTFE	0.455	(11.56)
Outer Conductor	Aluminum Tape	0.461	(11.71)
Overall Braid	Tinned Copper	0.490	(12.45)
Jacket	Orange FRPVC	0.590	(14.99)

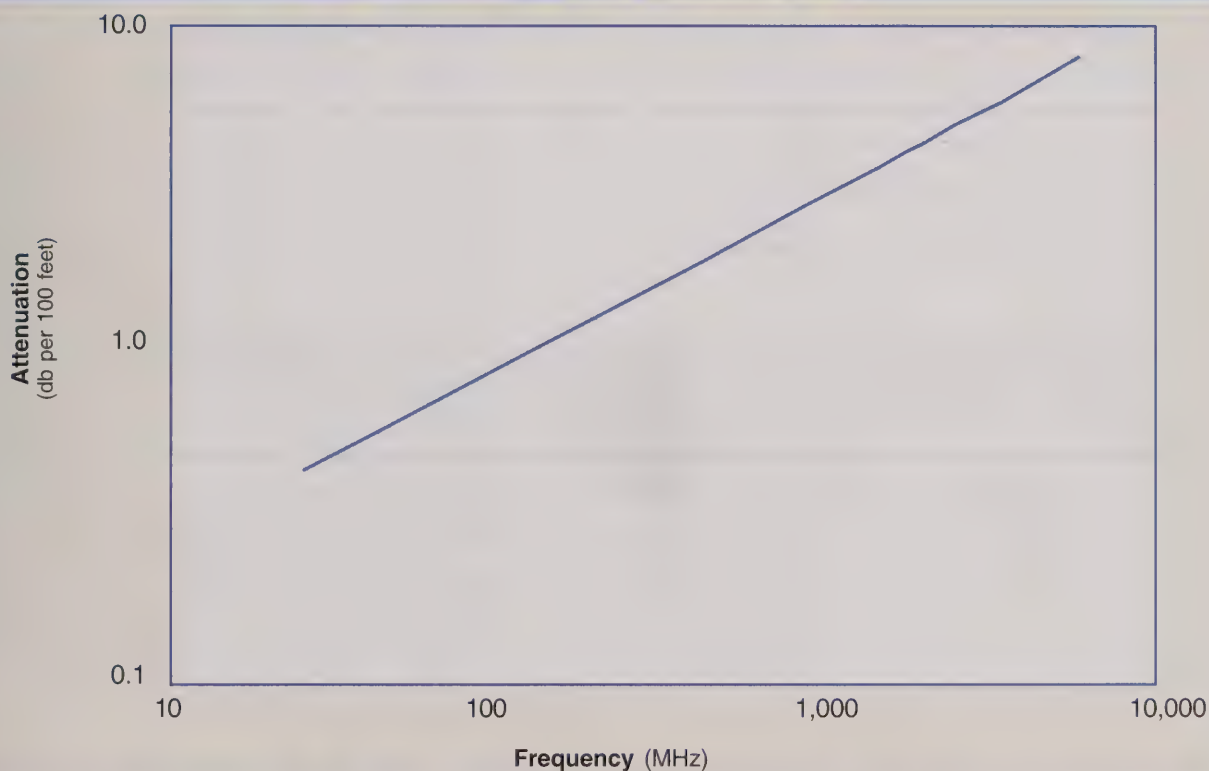
Environmental Specifications			
Performance Property	°F	°C	
Installation Temperature Range	-23/+167	-5/+75	
Storage Temperature Range	-23/+167	-5/+75	
Operating Temperature Range	-23/+167	-5/+75	

Electrical Specifications			
Performance Property	Units	US	(metric)
Cutoff Frequency	GHz		9.4
Velocity of Propagation	%		76
Dielectric Constant	NA		1.73
Time Delay	nS/ft (nS/m)	1.34	(4.40)
Impedance	ohms		50
Capacitance	pF/ft (pF/m)	26.7	(87.6)
Inductance	uH/ft (uH/m)	0.067	(0.22)
Shielding Effectiveness	dB		>90
DC Resistance			
Inner Conductor	ohms/1000ft (/km)	0.7	(2.4)
Outer Conductor	ohms/1000ft (/km)	1.20	(3.9)
Voltage Withstand	Volts DC		4000
Jacket Spark	Volts RMS		8000
Peak Power	kW		40

Mechanical Specifications

Performance Property	Units	US	(metric)
Bend Radius: installation	in. (mm)	1.5	(38.1)
Bend Radius: repeated	in (mm)	6.0	(152.4)
Bending Moment	ft-lb (N-m)	2.75	(3.73)
Weight	lb/ft (kg/m)	0.24	(0.36)
Tensile Strength	lb (kg)	265	(120.3)
Flat Plate Crush	lb/in. (kg/mm)	210	(3.75)

Attenuation vs. Frequency (typical)



Frequency (MHz)	30	50	150	220	450	900	1500	1800	2000	2500	3400	5800
Attenuation dB/100 ft	0.5	0.6	1.0	1.2	1.8	2.6	3.4	3.7	3.9	4.4	5.3	7.1
Attenuation dB/100 m	1.5	1.9	3.3	4.1	5.9	8.5	11.1	12.2	12.9	14.5	17.2	23.2
Avg. Power kW	6.97	5.39	3.08	2.53	1.75	1.22	0.93	0.84	0.79	0.70	0.59	0.44

Calculate Attenuation =

$(0.081390) \cdot \sqrt{\text{FMHz}} + (0.000150) \cdot \text{FMHz}$ (interactive calculator available at <http://www.timesmicrowave/telecom>)

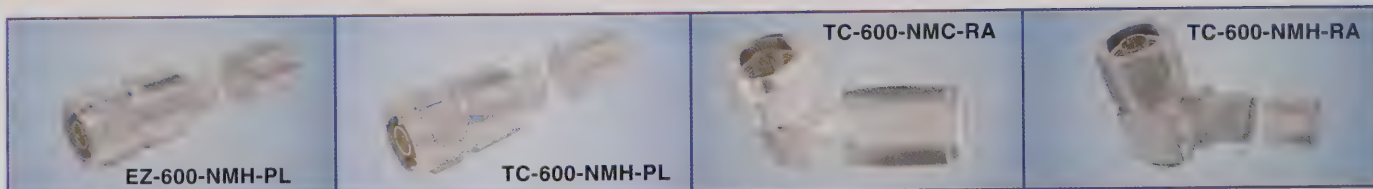
Attenuation:

VSWR=1.0 ; Ambient = +25°C (77°F)

Power:

VSWR=1.0; Ambient = +40°C; Inner Conductor = 100°C (212°F); Sea Level; dry air; atmospheric pressure; no solar loading

LMR-600-LLPL Flexible Low Loss Plenum Coax



Connectors

Interface	Description	Part Number	Stock Code	VSWR** Freq. (GHz)	Coupling Nut	Inner Contact Attach	Outer Contact Attach	Finish* Body /Pin	Length in (mm)	Width in (mm)	Weight lb (g)
N Male	Straight Plug	EZ-600-NMH-PL	3190-603	<1.25:1 (2.5)	Hex	Spring Finger	Crimp	S/G	2.1 (53)	0.92 (23.4)	0.166 (75.3)
	Straight Plug	TC-600-NMH-PL	3190-760	<1.25:1 (2.5)	Hex	Solder	Crimp	S/G	2.1 (53)	0.92 (23.4)	0.208 (93.4)
	Right Angle	TC-600-NMC-RA	3190-233	<1.35:1 (2.5)	Hex	Solder	Clamp	SG	2.1 (53)	0.92 (23.4)	0.280 (127.9)
	Right Angle	TC-600-NMH-RA	3190-785	<1.35:1 (6)	Hex	Solder	Crimp	SG	2.1 (53)	0.92 (23.4)	0.185 (83.9)

* Finish metals: N=Nickel, S=Silver, G=Gold, SS=Stainless Steel, A=Alloy **VSWR spec based on 3 foot cable with a connector pair



Hardware Accessories

Type	Part Number	Stock Code	Description
Ground Kit	GK-S600T	GK-S600T	Standard Grounding Kit (each)
Hoisting Grip	HG-600T	HG-600T	Split/Laced Type (each)
Cold Shrink	CS-A600T	CS-A600T	Cable to Antenna Junction (each)
Cold Shrink	CS-60120T	CS-60120T	LMR-600 to -1200 Junction (each)
Cold Shrink	CS-60170T	CS-60170T	LMR-600 to -1700 Junction (each)
Hanger Blocks	CB-600T	CB-600T	Dual Cable Support Block (kit of 10)
Hanger Block Supporting Hardware			Complete Range of Supporting Hardware & Adapters Available
Snap-In Hangers	SH-U600T	SH-U600T	Snap-In Hangers (Kit of 10)



Install Tools

Type	Part Number	Stock Code	Description
Crimp Tool	HX-4	3190-200	Crimp Handle
Crimp Dies	Y1720	3190-203	.610" Hex Dies
Crimp Rings	CR-600	3190-831	Crimp Rings for TC/EZ-600 connectors (pkg of 10)
Strip Tool	ST-600C	3190-230	For Clamp Style Connectors
Strip Tool	ST-600EZ	3190-310	For Crimp Style Connectors
Deburr Tool	DBT-01	3190-406	Removes center conductor rough edges
Midspan Strip Tool	GST-600A	3190-1051	For ground strap attachment
Cutting Tool	CCT-01	3190-1544	Cable end flush cut tool
Replacement Blades	RB-01	3190-1609	Replacement blades for cutting tool
Tool Kit	TK-600EZ	3190-1602	Tool kit for LMR-600 Crimp Connectors (includes CCT-01, ST-600EZ, HX-4, Y1720, DBT-01, Tool Pouch)

TIMES MICROWAVE SYSTEMS

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LMR-900-LLPL Flexible Low Loss Plenum Coax

Ideal for...

- Indoor Plenum Feeder runs
- UL/NEC/CSA rated CMP/MPP/FT6
- Any wireless application (e.g. LMDS, MMDS, WLL, GPS, LMR, Cellular, PCS, Paging) requiring an easily routed, low loss RF cable for in-building systems



• **LMR®-LLPL** is an indoor highly fire retarded cable intended specifically for runs within return air handling plenums (e.g. dropped ceilings, raised floors). It has a UL/NEC & CSA rating of 'CMP/MPP' and 'FT6' respectively.

• **Flexibility** and bendability are hallmarks of the LMR-900-LLPL cable design. The flexible outer conductor enables the tightest bend radius available for any cable of similar size and performance.

• **Low Loss** is another hallmark feature of LMR-900-LLPL. Size for size LMR has the lowest loss of any flexible cable and comparable loss to semirigid hard-line cables.

• **RF Shielding** is 50 dB greater than typical single shielded coax (40 dB). The multi-ply bonded foil outer conductor is rated conservatively at > 90 dB (i.e. >180 dB between two adjacent cables).

• **Weatherability:** LMR-900-LLPL cables are designed for indoor Plenum applications. Black jacketed LMR-LLPL versions can be supplied for applications that originate outdoors (e.g., rooftop) and subsequently enter the building.

• **Connectors:** Type-N male and female connectors are available for LMR-900-LLPL cable. Other interface types can be provided by using a short jumper cable assembly.

• **Cable Assemblies:** All LMR-900-LLPL cable types are available as pre-terminated cable assemblies. Refer to the section on FlexTech for further details.

Part Description				
Part No.	Application	Jacket	Color	Stock Code
LMR-900-LLPL	Indoor Plenum CMP/FT6	FRPVC	Orange	54062

Construction Specifications			
Description	Material	In.	(mm)
Inner Conductor	BC Tube	0.227	(5.77)
Dielectric	Low density PTFE	0.680	(17.27)
Outer Conductor	Aluminum Tape	0.686	(17.42)
Overall Braid	Tinned Copper	0.732	(18.59)
Jacket	Orange FRPVC	0.870	(22.10)

Mechanical Specifications

Performance Property	Units	US	(metric)
Bend Radius: installation	in. (mm)	4.5	(114.3)
Bend Radius: repeated	in. (mm)	9.0	(228.6)
Bending Moment	ft-lbs (N-m)	9.0	(12.20)
Weight	lbs/ft (kg/m)	0.62	(0.92)
Tensile Strength	lbs (kg)	660	(299.6)
Flat Plate Crush	lbs/in. (kg/mm)	300	(5.36)

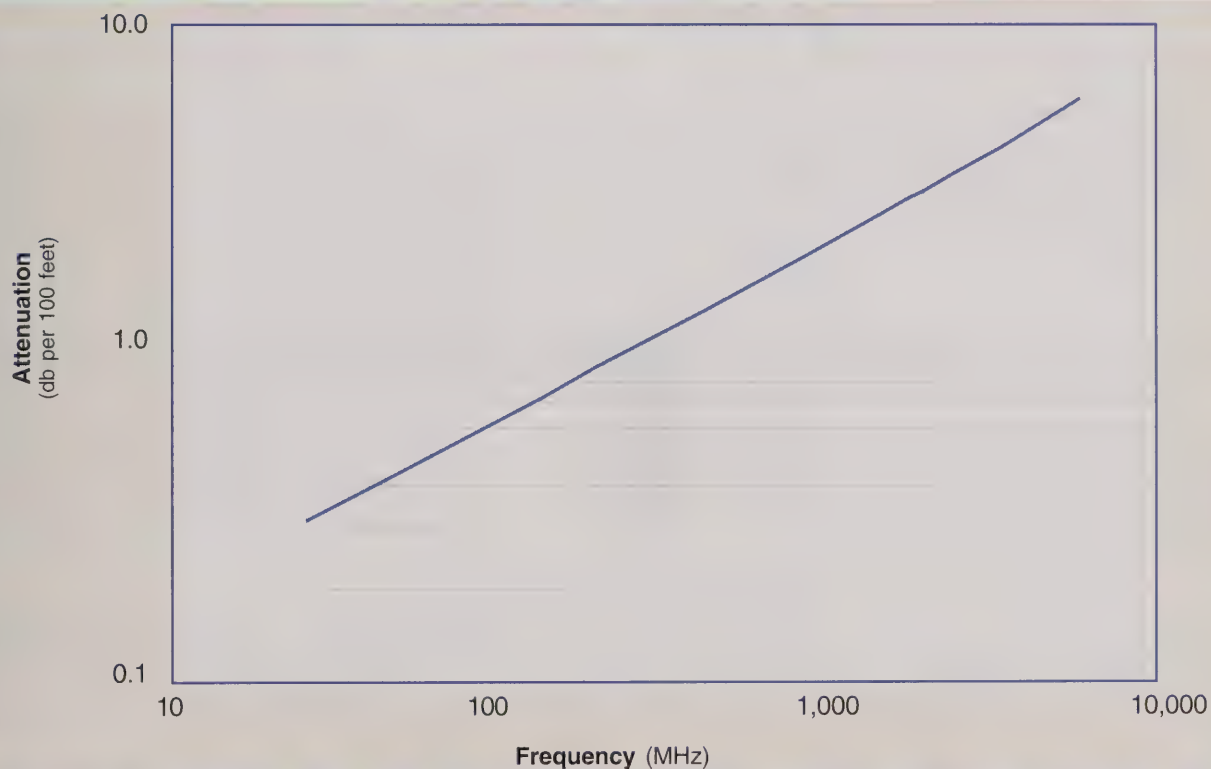
Environmental Specifications

Performance Property	°F	°C
Installation Temperature Range	-23/+167	-5/+75
Storage Temperature Range	-23/+167	-5/+75
Operating Temperature Range	-23/+167	-5/+75

Electrical Specifications

Performance Property	Units	US	(metric)
Cutoff Frequency	GHz	6.3	
Velocity of Propagation	%	76	
Dielectric Constant	NA	1.73	
Time Delay	nS/ft (nS/m)	1.34	(4.40)
Impedance	ohms	50	
Capacitance	pF/ft (pF/m)	26.7	(87.6)
Inductance	uH/ft (uH/m)	0.067	(0.22)
Shielding Effectiveness	dB	>90	
DC Resistance			
Inner Conductor	ohms/1000ft (/km)	0.6	(2.0)
Outer Conductor	ohms/1000ft (/km)	0.55	(1.8)
Voltage Withstand	Volts DC	5000	
Jacket Spark	Volts RMS	8000	
Peak Power	kW	82	

Attenuation vs. Frequency (typical)



Frequency (MHz)	30	50	150	220	450	900	1500	1800	2000	2500	3400	5800
Attenuation dB/100 ft	0.3	0.4	0.7	0.9	1.3	1.9	2.5	2.8	2.9	3.3	4.0	5.4
Attenuation dB/100 m	1.0	1.4	2.4	2.9	4.3	6.2	8.2	9.0	9.6	10.9	13.0	17.8
Avg. Power kW	13.21	19.18	5.77	4.74	3.25	2.24	1.69	1.52	1.44	1.26	1.06	0.77

Calculate Attenuation =

$(0.057220) \cdot \sqrt{\text{FMHz}} + (0.000183) \cdot \text{FMHz}$ (interactive calculator available at <http://www.timesmicrowave/telecom>)

Attenuation:

VSWR=1.0 ; Ambient = +25°C (77°F)

Power:

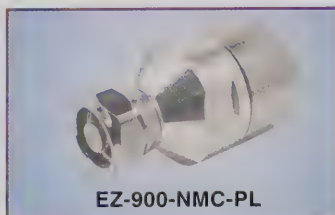
VSWR=1.0; Ambient = +40°C; Inner Conductor = 100°C (212°F); Sea Level; dry air; atmospheric pressure; no solar loading

TIMES MICROWAVE SYSTEMS

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LMR-900-LLPL

Flexible Low Loss Plenum Coax



EZ-900-NMC-PL

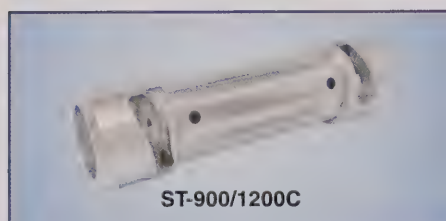


EZ-900-NFC-PL

Connectors

Interface	Description	Part Number	Stock Code	VSWR** Freq. (GHz)	Coupling Nut	Inner Contact Attach	Outer Contact Attach	Finish* Body /Pin	Length in (mm)	Width in (mm)	Weight lb (g)
N Male	Straight Plug	EZ-900-NMC-PL	3190-909	<1.25:1 (25)	Hex	Spring Finger	Clamp	S/S	2.0 (51)	1.38 (35.1)	0.463 (210.0)
N Female	Straight Jack	EZ-900-NFC-PL	3190-910	<1.25:1 (25)	NA	Spring Finger	Clamp	S/G	2.0 (51)	1.38 (35.1)	0.443 (200.9)

* Finish metals: N=Nickel, S=Silver, G=Gold, SS=Stainless Steel, A=Alballoy **VSWR spec based on 3 foot cable with a connector pair



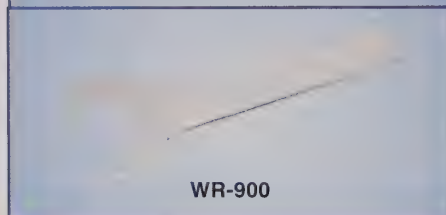
ST-900/1200C



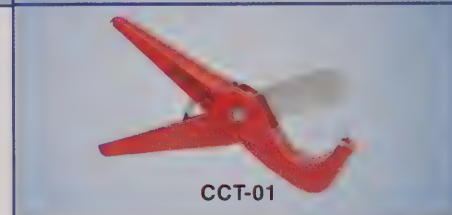
ST900C



GST-900A



WR-900



CCT-01

Install Tools

Type	Part Number	Stock Code	Description
Strip Tool	ST-900/1200C	3190-311	For LMR 900 & 1200 Clamp Style Connectors
Strip Tool	ST-900C	3190-1310	For LMR 900 Clamp Style Connectors
Midspan Strip Tool	GST-900A	3190-435	For Ground Strap Attachment
Wrenches	WR-900	3190-510	1-1/4" Box Wrench (2 required)
Cutting Tool	CCT-01	3190-1544	Cable end flush cut tool
Replacement Blades	RB-01	3190-1609	Replacement blades for cutting tool



Hardware Accessories

Type	Part Number	Stock Code	Description
Ground Kit	GK-S900T	GK-S900T	Standard Grounding Kit (each)
Hoisting Grip	HG-900T	HG-900T	Split/Laced Type (each)
Cold Shrink	CS-A900T	CS-A900T	Cable to Antenna Junction (each)
Cold Shrink	CS-90120T	CS-90120T	LMR-900 to -1200 Junction (each)
Cold Shrink	CS-90170T	CS-90170T	LMR-900 to -1700 Junction (each)
Port Cushion	SC-900T	SC-900T	Three Cables (each)
Standard Entry Panels			Full Range of Port Styles/Combinations Available
Hanger Blocks	CB-900T	CB-900T	Dual Cable Support Block (kit of 10)
Hanger Block Supporting Hardware			Complete Range of Supporting Hardware and Adapters Available
Snap-in Hangers	SH-U900T	SH-U900T	Snap-in Hanger (Kit of 10)

LMR-1200-LLPL Flexible Low Loss Plenum Coax

Ideal for...

- Indoor Plenum Feeder runs
- UL/NEC/CSA rated CMP/MPP/FT6
- Any wireless application (e.g. LMDS, MMDS, WLL, GPS, LMR, Cellular, PCS, Paging) requiring an easily routed, low loss RF cable for in-building systems



• **LMR®-LLPL** is an indoor highly fire retarded cable intended specifically for runs within return air handling plenums (e.g. dropped ceilings, raised floors). It has a UL/NEC & CSA rating of 'CMP/MPP' and 'FT6' respectively.

• **Flexibility** and bendability are hallmarks of the LMR-1200-LLPL cable design. The flexible outer conductor enables the tightest bend radius available for any cable of similar size and performance.

• **Low Loss** is another hallmark feature of LMR-1200-LLPL. Size for size LMR has the lowest loss of any flexible cable and comparable loss to semirigid hard-line cables.

• **RF Shielding** is 50 dB greater than typical single shielded coax (40 dB). The multi-ply bonded foil outer conductor is rated conservatively at > 90 dB (i.e. >180 dB between two adjacent cables).

• **Weatherability:** LMR-1200-LLPL cables are designed for indoor Plenum applications. Black jacketed LMR-LLPL versions can be supplied for applications that originate outdoors (e.g., rooftop) and subsequently enter the building.

• **Connectors:** Type-N male and female connectors are available for LMR-1200-LLPL cable. Other interface types can be provided by using a short jumper cable assembly.

• **Cable Assemblies:** All LMR-1200-LLPL cable types are available as pre-terminated cable assemblies. Refer to the section on FlexTech for further details.

Part Description				
Part No.	Application	Jacket	Color	Stock Code
LMR-1200-LLPL	Indoor Plenum CMP/FT6	FRPVC	Orange	54063

Construction Specifications			
Description	Material	In.	(mm)
Inner Conductor	BC Tube	0.310	(7.87)
Dielectric	Low density PTFE	0.920	(23.37)
Outer Conductor	Aluminum Tape	0.926	(23.52)
Overall Braid	Tinned Copper	0.937	(23.80)
Jacket	Orange FRPVC	1.200	(30.48)

Mechanical Specifications

Performance Property	Units	US	(metric)
Bend Radius: installation	in. (mm)	6.0	(152.4)
Bend Radius: repeated	in.s (mm)	12.0	(304.8)
Bending Moment	ft-lbs (N-m)	15.0	(20.34)
Weight	lbs/ft (kg/m)	0.7	(1.04)
Tensile Strength	lbs (kg)	975	(442.7)
Flat Plate Crush	lbs/in. (kg/mm)	375	(6.70)

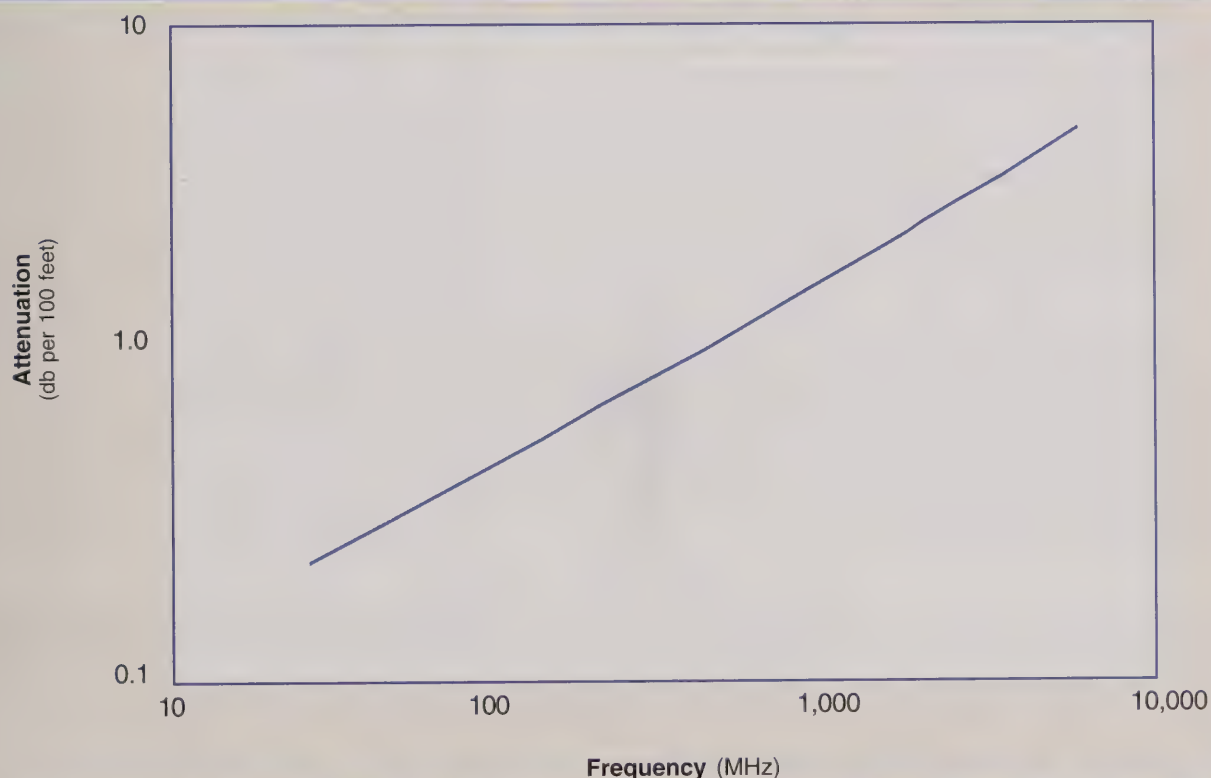
Environmental Specifications

Performance Property	°F	°C
Installation Temperature Range	-23/+167	-5/+75
Storage Temperature Range	-23/+167	-5/+75
Operating Temperature Range	-23/+167	-5/+75

Electrical Specifications

Performance Property	Units	US	(metric)
Cutoff Frequency	GHz	4.6	
Velocity of Propagation	%	76	
Dielectric Constant	NA	1.73	
Time Delay	nS/ft (nS/m)	1.34	(4.40)
Impedance	ohms	50	
Capacitance	pF/ft (pF/m)	26.7	(87.6)
Inductance	uH/ft (uH/m)	0.067	(0.22)
Shielding Effectiveness	dB	>90	
DC Resistance			
Inner Conductor	ohms/1000ft (/km)	0.4	(1.2)
Outer Conductor	ohms/1000ft (/km)	0.37	(1.2)
Voltage Withstand	Volts DC	9000	
Jacket Spark	Volts RMS	8000	
Peak Power	kW	90	

Attenuation vs. Frequency (typical)



Frequency (MHz)	30	50	150	220	450	900	1500	1800	2000	2500	3400
Attenuation dB/100 ft	0.2	0.3	0.5	0.7	1.0	1.4	1.9	2.1	2.2	2.5	3.1
Attenuation dB/100 m	0.8	1.0	1.8	2.2	3.2	4.6	6.2	6.9	7.3	8.3	10.0
Avg. Power kW	23.42	18.01	10.17	8.31	5.66	3.86	2.90	2.60	2.45	2.15	1.79

Calculate Attenuation =

$(0.041720) \cdot \sqrt{\text{FMHz}} + (0.000183) \cdot \text{FMHz}$ (interactive calculator available at <http://www.timesmicrowave/telecom>)

Attenuation:

VSWR=1.0 ; Ambient = +25°C (77°F)

Power:

VSWR=1.0; Ambient = +40°C; Inner Conductor = 100°C (212°F); Sea Level; dry air; atmospheric pressure; no solar loading

TIMES MICROWAVE SYSTEMS

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LMR-1200-LLPL Flexible Low Loss Plenum Coax



EZ-1200-NMC-PL

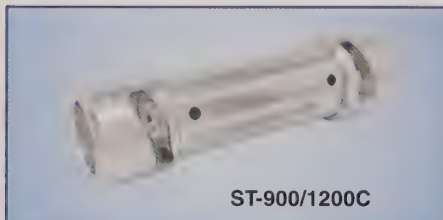


EZ-1200-NFC-PL

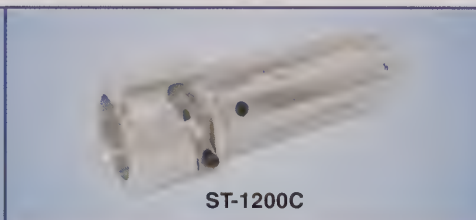
Connectors

Interface	Description	Part Number	Stock Code	VSWR** Freq. (GHz)	Coupling Nut	Inner Contact Attach	Outer Contact Attach	Finish* Body /Pin	Length in (mm)	Width in (mm)	Weight lb (g)
N Male	Straight Plug	EZ-1200-NMC-PL	3190-911	<1.25:1 (25)	Hex	Press Fit	Clamp	S/S	2.0 (51)	1.65 (41.9)	0.659 (298.9)
N Female	Straight Jack	EZ-1200-NFC-PL	3190-912	<1.25:1 (25)	NA	Press Fit	Clamp	S/S	2.0 (51)	1.65 (41.9)	0.650 (294.8)

* Finishes: N=Nickel, S=Silver, G=Gold, SS=Stainless Steel, A=Alballoy **VSWR spec based on 3 foot cable with a connector pair



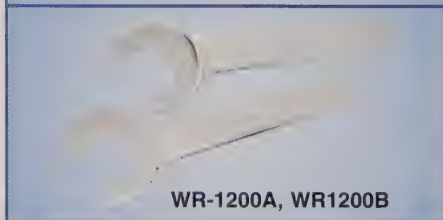
ST-900/1200C



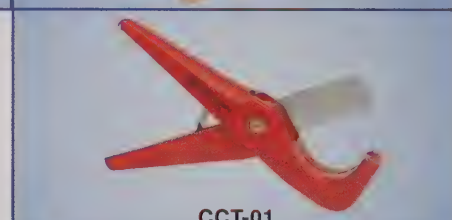
ST-1200C



GST-1200A



WR-1200A, WR1200B



CCT-01

Install Tools

Type	Part Number	Stock Code	Description
Strip Tool	ST-900/1200C	3190-311	For LMR 900 & 1200 Clamp Style Connectors
Strip Tool	ST-1200C	3190-1311	For LMR 1200 Clamp Style Connectors
Midspan Strip Tool	GST-1200A	3190-436	For Ground Strap Attachment
Wrench	WR-1200A	3190-512	1-9/16" Box Wrench (1 required)
Wrench	WR-1200B	3190-511	1-7/16" Box Wrench Pair (1 required)
Cutting Tool	CCT-01	3190-1544	Cable end flush cut tool
Replacement Blades	RB-01	3190-1609	Replacement blades for cutting tool



Hardware Accessories

Type	Part Number	Stock Code	Description
Ground Kit	GK-S1200T	GK-S1200T	Standard Grounding Kit (each)
Hoisting Grip	HG-1200T	HG-1200T	Split/Laced Type (each)
Cold Shrink	CS-90120T	CS-90120T	LMR-900 to -1200 Junction (each)
Cold Shrink	CS-60120T	CS-60120T	LMR-600 to -1200 Junction (each)
Standard Entry Port Cushion	SC-1200T	SC-1200T	Three Cables (each)
Standard Entry Panels	Full Range of Port Styles/Combinations Available		
Hanger Blocks	CB-1200T	CB-1200T	Dual Cable Support Block (kit of 10)
Hanger Block Supporting Hardware	Complete Range of Supporting Hardware & Adapters Available		
Snap-In Hangers	SH-U1200T	SH-U1200T	Snap-In Hangers (Kit of 10)

TIMES MICROWAVE SYSTEMS

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LMR-200-75 Ohm Flexible Low Loss Coaxial Cable

Ideal for...

- Video Applications-CCTV, CATV, baseband or broadband
- In-Building Feeder Runs
- Any 75 ohm Wireless Application requiring an easily routed, low loss RF cable



• **LMR® -75** standard is a UV Resistant Polyethylene jacketed cable designed for 20-year service outdoor use. The bending and handling characteristics are significantly better than any smooth wall or corrugated hard-line cables.

• **Flexibility** and bendability are hallmarks of the LMR-200-75 cable design. The flexible outer conductor enables the tightest bend radius available for any cable of similar size and performance.

• **Low Loss** is another hallmark feature of LMR-200-75. Size for size LMR-75 has the lowest loss of any flexible cable and comparable loss to semirigid hard-line cables.

• **RF Shielding** is 50 dB greater than typical single shielded coax (40 dB). The multi-ply bonded foil outer conductor is rated conservatively at > 90 dB (i.e. >180 dB between two adjacent cables).

• **Weatherability:** LMR-200-75 cables designed for outdoor exposure incorporate the best materials for UV resistance and have life expectancy in excess of 20 years.

• **Connectors:** Standard available connectors include type-N and type-F male plug with 75 ohm interface. Most LMR-75 connectors are the EZ install type with crimp outer and non-solder center contact attachment.

• **Cable Assemblies:** All LMR-200-75 cable types are available as pre-terminated cable assemblies. Refer to the section on FlexTech for further details.

Construction Specifications			
Description	Material	In.	(mm)
Inner Conductor	Solid BC	0.025	(0.64)
Dielectric	Foam PE	0.116	(2.95)
Outer Conductor	Aluminum Tape	0.121	(3.07)
Overall Braid	Tinned Copper	0.144	(3.66)
Jacket	Black PE	0.195	(4.95)

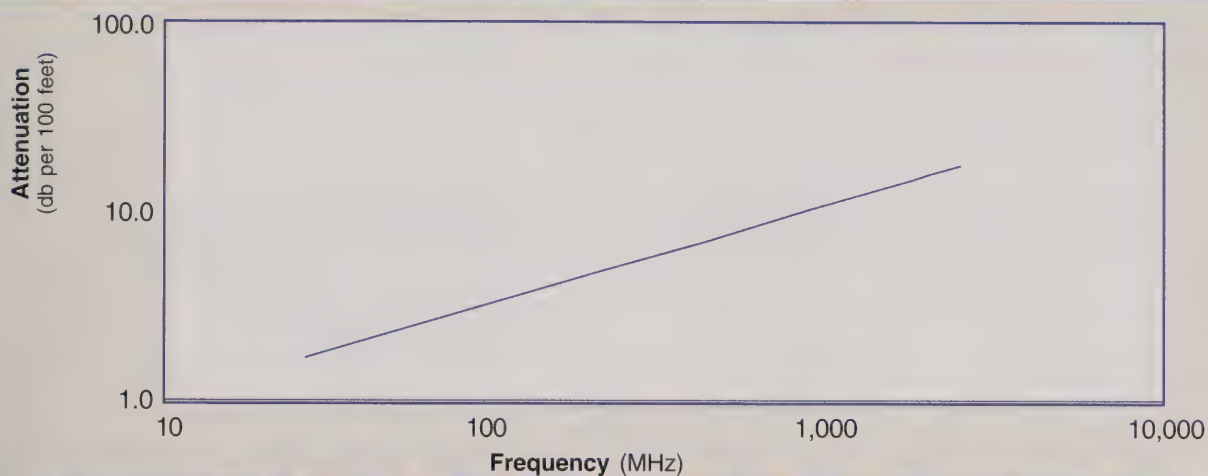
Mechanical Specifications			
Performance Property	Units	US	(metric)
Bend Radius: installation	in. (mm)	0.5	(12.7)
Bend Radius: repeated	in. (mm)	2	(50.8)
Bending Moment	ft-lb (N-m)	0.2	(0.27)
Weight	lb/ft (kg/m)	0.022	(0.03)
Tensile Strength	lb (kg)	40	(18.2)
Flat Plate Crush	lb/in. (kg/mm)	15	(0.27)

Environmental Specifications			
Performance Property	°F	°C	
Installation Temperature Range	-40/+185	-40/+85	
Storage Temperature Range	-94/+185	-70/+185	
Operating Temperature Range	-40/+185	-40/+85	

Electrical Specifications			
Performance Property	Units	US	(metric)
Max Operating Frequency	GHz	2.5	
Velocity of Propagation	%	83	
Dielectric Constant	NA	1.45	
Time Delay	nS/ft (nS/m)	1.22	(4.02)
Impedance	ohms	75	
Capacitance	pF/ft (pF/m)	16.3	(53.6)
Inductance	uH/ft (uH/m)	0.092	(0.30)
Shielding Effectiveness	dB	>90	
DC Resistance			
Inner Conductor	ohms/1000ft (/km)	16.2	(53.2)
Outer Conductor	ohms/1000ft (/km)	4.9	(16.1)
Voltage Withstand	Volts DC	1000	
Jacket Spark	Volts RMS	3000	
Peak Power	kW	2.5	

Part Description				
Part No.	Application	Jacket	Color	Stock Code
LMR-200-75	Indoor/Outdoor	PE	Black	54213

Attenuation vs. Frequency (typical)

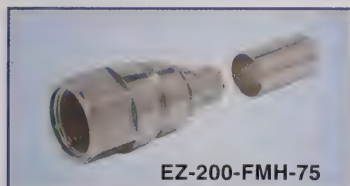


Frequency (MHz)	30	50	150	220	450	900	1500	1800	2000	2500
Attenuation dB/100 ft	1.7	2.1	3.7	4.5	6.5	9.3	12.1	13.4	14.1	15.9
Attenuation dB/100 m	5.4	7.0	12.2	14.9	21.4	30.6	39.8	43.8	46.3	52.0
Avg. Power kW	0.98	0.76	0.43	0.36	0.25	0.17	0.13	0.12	0.11	0.10

Calculate Attenuation = $(0.300717) \cdot \sqrt{\text{FMHz}} + (0.000335) \cdot \text{FMHz}$ (interactive calculator available at <http://www.timesmicrowave/telecom>)

Attenuation: VSWR=1.0 ; Ambient = +25°C (77°F)

Power: VSWR=1.0; Ambient = +40°C; Inner Conductor = 100°C (212°F); Sea Level; dry air; atmospheric pressure; no solar loading



EZ-200-FMH-75



EZ-200-NM-75

Connectors

Interface	Description	Part Number	Stock Code	VSWR**	Coupling	Inner Contact Attach	Outer Contact Attach	Finish*	Length in (mm)	Width in (mm)	Weight lb (g)
F male	Straight Plug	EZ-200-FMH-75	3190-1611	<1.35:1 (2.5)	Hex	Spring Finger	Crimp	NG	1.1 (27.0)	0.50 (12.7)	0.015 (6.8)
N male	Straight Plug	EZ-200-NM-75	3190-1612	<1.35:1 (2.5)	Knurl	Spring Finger	Crimp	NG	1.5 (38.1)	0.83 (21.1)	0.073 (33.1)

* Finish metals: N=Nickel, S=Silver, G=Gold, SS=Stainless Steel, A=Alballoy **VSWR spec based on 3 foot cable with a connector pair



GK-S200T

Accessories

Type	Part Number	Stock Code	Description
Ground Kit	GK-S200T	GK-S200T	Standard Grounding Kit

TIMES MICROWAVE SYSTEMS

A Smiths Group plc company

LMR-240-75 Ohm Flexible Low Loss Coaxial Cable

Ideal for...

- Video Applications-CCTV, CATV, baseband or broadband
- In-Building Feeder Runs
- Any 75 ohm Wireless Application requiring an easily routed, low loss RF cable



• **LMR® -75** standard is a UV Resistant Polyethylene jacketed cable designed for 20-year service outdoor use. The bending and handling characteristics are significantly better than any smooth wall or corrugated hard-line cables.

• **Flexibility** and bendability are hallmarks of the LMR-240-75 cable design. The flexible outer conductor enables the tightest bend radius available for any cable of similar size and performance.

• **Low Loss** is another hallmark feature of LMR-240-75. Size for size LMR-75 has the lowest loss of any flexible cable and comparable loss to semirigid hard-line cables.

• **RF Shielding** is 50 dB greater than typical single shielded coax (40 dB). The multi-ply bonded foil outer conductor is rated conservatively at > 90 dB (i.e. >180 dB between two adjacent cables).

• **Weatherability:** LMR-240-75 cables designed for outdoor exposure incorporate the best materials for UV resistance and have life expectancy in excess of 20 years.

• **Connectors:** Standard available connectors include type-N and type-F male plug with 75 ohm interface. Most LMR-75 connectors are the EZ install type with crimp outer and non-solder center contact attachment.

• **Cable Assemblies:** All LMR-240-75 cable types are available as pre-terminated cable assemblies. Refer to the section on FlexTech for further details.

Construction Specifications			
Description	Material	In.	(mm)
Inner Conductor	Solid BC	0.032	(0.82)
Dielectric	Foam PE	0.150	(3.81)
Outer Conductor	Aluminum Tape	0.155	(3.94)
Overall Braid	Tinned Copper	0.178	(4.52)
Jacket	Black PE	0.240	(6.10)

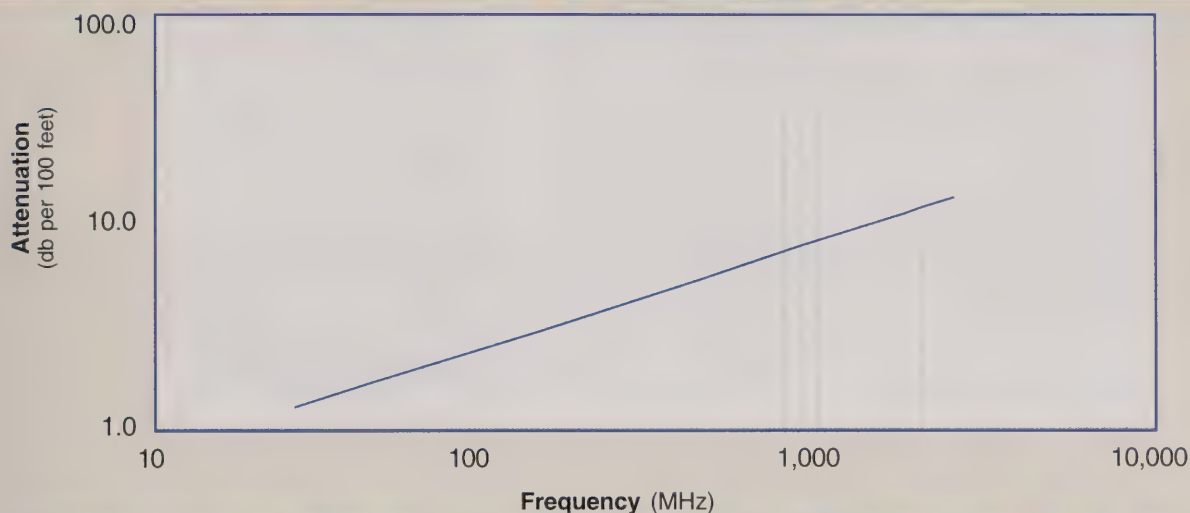
Mechanical Specifications			
Performance Property	Units	US	(metric)
Bend Radius: installation	in. (mm)	0.8	(19.1)
Bend Radius: repeated	in. (mm)	2.5	(63.5)
Bending Moment	ft-lb (N-m)	0.25	(0.34)
Weight	lb/ft (kg/m)	0.034	(0.05)
Tensile Strength	lb (kg)	80	(38.3)
Flat Plate Crush	lb/in. (kg/mm)	20	(0.36)

Environmental Specifications			
Performance Property	°F	°C	
Installation Temperature Range	-40/+185	-40/+85	
Storage Temperature Range	-94/+185	-70/+185	
Operating Temperature Range	-40/+185	-40/+85	

Electrical Specifications			
Performance Property	Units	US	(metric)
Max Operating Frequency	GHz	2.5	
Velocity of Propagation	%	84	
Dielectric Constant	NA	1.42	
Time Delay	nS/ft (nS/m)	1.21	(3.97)
Impedance	ohms	75	
Capacitance	pF/ft (pF/m)	16.1	(52.9)
Inductance	uH/ft (uH/m)	0.091	(0.30)
Shielding Effectiveness	dB	>90	
DC Resistance			
Inner Conductor	ohms/1000ft (/km)	10.1	(33.1)
Outer Conductor	ohms/1000ft (/km)	3.89	(12.8)
Voltage Withstand	Volts DC	1500	
Jacket Spark	Volts RMS	5000	
Peak Power	kW	5.6	

Part Description				
Part No.	Application	Jacket	Color	Stock Code
LMR-240-75	Indoor/Outdoor	PE	Black	54150

Attenuation vs. Frequency (typical)



Frequency (MHz)	30	50	150	220	450	900	1500	1800	2000	2500
Attenuation dB/100 ft	1.3	1.6	2.9	3.5	5.0	7.2	9.4	10.3	10.9	12.3
Attenuation dB/100 m	4.1	5.4	9.4	11.4	16.4	23.5	30.7	33.8	35.8	40.3
Avg. Power kW	1.41	1.09	0.62	0.51	0.35	0.25	0.19	0.17	0.16	0.14

Calculate Attenuation =

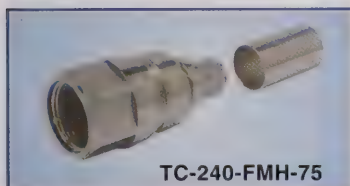
$(0.229100) \cdot \sqrt{\text{FMHz}} + (0.000330) \cdot \text{FMHz}$ (interactive calculator available at <http://www.timesmicrowave/telecom>)

Attenuation:

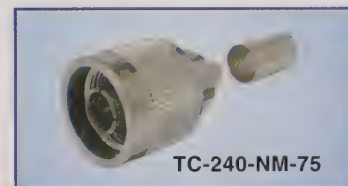
VSWR=1.0 ; Ambient = +25°C (77°F)

Power:

VSWR=1.0; Ambient = +40°C; Inner Conductor = 100°C (212°F); Sea Level; dry air; atmospheric pressure; no solar loading



TC-240-FMH-75



TC-240-NM-75

Connectors

Interface	Description	Part Number	Stock Code	VSWR** Freq. (GHz)	Coupling Nut	Inner Contact Attach	Outer Contact Attach	Finish* Body /Pin	Length in (mm)	Width in (mm)	Weight lb (g)
F male	Straight Plug	TC-240-FMH-75	3190-1483	<1.25:1 (2.5)	Hex	Spring Finger	Crimp	NG	1.71 (43.2)	0.56 (14.2)	0.016 (7.3)
N male	Straight Plug	TC-240-NM-75	3190-477	<1.25:1 (2.5)	Knurl	Spring Finger	Crimp	NG	1.5 (38.1)	0.83 (21.1)	0.086 (39.0)

* Finish metals: N=Nickel, S=Silver, G=Gold, SS=Stainless Steel, A=Alballoy **VSWR spec based on 3 foot cable with a connector pair



GK-S240T

Accessories

Type	Part Number	Stock Code	Description
Ground Kit	GK-S240T	GK-S240T	Standard Grounding Kit

TIMES MICROWAVE SYSTEMS

A Smiths Group plc company

LMR-300-75 Ohm Flexible Low Loss Coaxial Cable

Ideal for...

- Video Applications-CCTV, CATV, baseband or broadband
- In-Building Feeder Runs
- Any 75 ohm Wireless Application requiring an easily routed, low loss RF cable



• **LMR® -75** standard is a UV Resistant Polyethylene jacketed cable designed for 20-year service outdoor use. The bending and handling characteristics are significantly better than any smooth wall or corrugated hard-line cables.

• **Flexibility** and bendability are hallmarks of the LMR-300-75 cable design. The flexible outer conductor enables the tightest bend radius available for any cable of similar size and performance.

• **Low Loss** is another hallmark feature of LMR-300-75. Size for size LMR-75 has the lowest loss of any flexible cable and comparable loss to semirigid hard-line cables.

• **RF Shielding** is 50 dB greater than typical single shielded coax (40 dB). The multi-ply bonded foil outer conductor is rated conservatively at > 90 dB (i.e. >180 dB between two adjacent cables).

• **Weatherability:** LMR-300-75 cables designed for outdoor exposure incorporate the best materials for UV resistance and have life expectancy in excess of 20 years.

• **Connectors:** Standard available connectors include type-N and type-F male plug with 75 ohm interface. Most LMR-75 connectors are the EZ install type with crimp outer and non-solder center contact attachment.

• **Cable Assemblies:** All LMR-300-75 cable types are available as pre-terminated cable assemblies. Refer to the section on FlexTech for further details.

Construction Specifications			
Description	Material	In.	(mm)
Inner Conductor	Solid BC	0.044	(1.12)
Dielectric	Foam PE	0.190	(4.83)
Outer Conductor	Aluminum Tape	0.196	(4.98)
Overall Braid	Tinned Copper	0.225	(5.72)
Jacket	Black PE	0.300	(7.62)

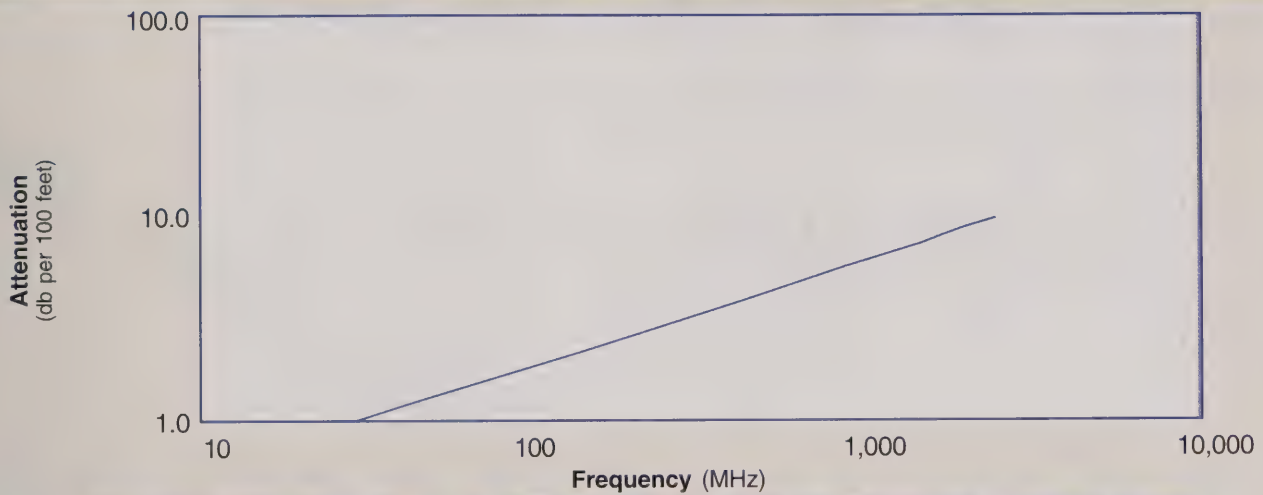
Mechanical Specifications			
Performance Property	Units	US	(metric)
Bend Radius: installation	in. (mm)	0.875	(22.2)
Bend Radius: repeated	in. (mm)	3.0	(76.2)
Bending Moment	ft-lb (N-m)	0.38	(0.52)
Weight	lb/ft (kg/m)	0.055	(0.08)
Tensile Strength	lb (kg)	120	(54.5)
Flat Plate Crush	lb/in. (kg/mm)	30	(0.54)

Environmental Specifications			
Performance Property	°F	°C	
Installation Temperature Range	-40/+185	-40/+85	
Storage Temperature Range	-94/+185	-70/+185	
Operating Temperature Range	-40/+185	-40/+85	

Electrical Specifications			
Performance Property	Units	US	(metric)
Max Operating Frequency	GHz	2.5	
Velocity of Propagation	%	85	
Dielectric Constant	NA	1.38	
Time Delay	nS/ft (nS/m)	1.20	(3.92)
Impedance	ohms	75	
Capacitance	pF/ft (pF/m)	15.9	(52.3)
Inductance	uH/ft (uH/m)	0.090	(0.29)
Shielding Effectiveness	dB	>90	
DC Resistance			
Inner Conductor	ohms/1000ft (/km)	5.36	(17.6)
Outer Conductor	ohms/1000ft (/km)	2.21	(7.3)
Voltage Withstand	Volts DC	2000	
Jacket Spark	Volts RMS	5000	
Peak Power	kW	10	

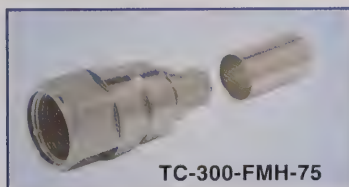
Part Description				
Part No.	Application	Jacket	Color	Stock Code
LMR-300-75	Indoor/Outdoor	PE	Black	54146

Attenuation vs. Frequency (typical)

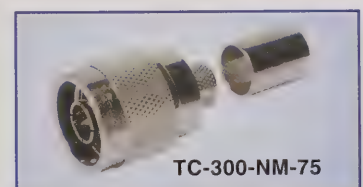


Frequency (MHz)	30	50	150	220	450	900	1500	1800	2000	2500
Attenuation dB/100 ft	1.0	1.3	2.2	2.7	3.9	5.6	7.3	8.0	8.5	9.6
Attenuation dB/100 m	3.2	4.1	7.2	8.8	12.7	18.2	23.9	26.4	27.9	31.5
Avg. Power kW	2.06	1.59	0.91	0.74	0.51	0.36	0.27	0.25	0.23	0.21

Calculate Attenuation = $(0.175490) \cdot \sqrt{\text{FMHz}} + (0.000330) \cdot \text{FMHz}$ (interactive calculator available at <http://www.timesmicrowave/telecom>)
 Attenuation: VSWR=1.0; Ambient = +25°C (77°F) Power: VSWR=1.0; Ambient = +40°C; Inner Conductor = 100°C (212°F);
 Sea Level; dry air; atmospheric pressure; no solar loading



TC-300-FMH-75



TC-300-NM-75

Connectors

Interface	Description	Part Number	Stock Code	VSWR** Freq. (GHz)	Coupling Nut	Inner Contact Attach	Outer Contact Attach	Finish* Body /Pin	Length in (mm)	Width in (mm)	Weight lb (g)
F male	Straight Plug	TC-300-FMH-75	3190-1615	<1.25:1 (2.5)	Hex	Spring Finger	Crimp	NG	1.7 (43.2)	0.56 (14.2)	0.018 (8.2)
N male	Straight Plug	TC-300-NM-75	3190-1616	<1.25:1 (2.5)	Knurl	Spring Finger	Crimp	NG	1.5 (38.1)	0.83 (21.1)	0.074 (33.6)

* Finish metals: N=Nickel, S=Silver, G=Gold, SS=Stainless Steel, A=Alballoy **VSWR specbased on 3 foot cable with a connector pair



GK-S300T

Accessories

Type	Part Number	Stock Code	Description
Ground Kit	GK-S300T	GK-S300T	Standard Grounding Kit

TIMES MICROWAVE SYSTEMS

A Smiths Group plc company

LMR-400-75 Ohm Flexible Low Loss Coaxial Cable

Ideal for...

- Video Applications-CCTV, CATV, baseband or broadband
- In-Building Feeder Runs
- Any 75 ohm Wireless Application requiring an easily routed, low loss RF cable

• **LMR®-75** standard is a UV Resistant Polyethylene jacketed cable designed for 20-year service outdoor use. The bending and handling characteristics are significantly better than any smooth wall or corrugated hard-line cables.

• **Flexibility** and bendability are hallmarks of the LMR-400-75 cable design. The flexible outer conductor enables the tightest bend radius available for any cable of similar size and performance.

• **Low Loss** is another hallmark feature of LMR-400-75. Size for size LMR-75 has the lowest loss of any flexible cable and comparable loss to semirigid hard-line cables.

• **RF Shielding** is 50 dB greater than typical single shielded coax (40 dB). The multi-ply bonded foil outer conductor is rated conservatively at > 90 dB (i.e. >180 dB between two adjacent cables).

• **Weatherability:** LMR-400-75 cables designed for outdoor exposure incorporate the best materials for UV resistance and have life expectancy in excess of 20 years.

• **Connectors:** Standard available connectors include type-N and type-F male plug with 75 ohm interface. Most LMR-75 connectors are the EZ install type with crimp outer and non-solder center contact attachment.

• **Cable Assemblies:** All LMR-400-75 cable types are available as pre-terminated cable assemblies. Refer to the section on FlexTech for further details.



Part Description

Part No.	Application	Jacket	Color	Stock Code
LMR-400-75	Indoor/Outdoor	PE	Black	54147

Construction Specifications

Description	Material	In.	(mm)
Inner Conductor	Solid BC	0.065	(1.65)
Dielectric	Foam PE	0.285	(7.24)
Outer Conductor	Aluminum Tape	0.291	(7.39)
Overall Braid	Tinned Copper	0.320	(8.13)
Jacket	Black PE	0.405	(10.29)

Mechanical Specifications

Performance Property	Units	US	(metric)
Bend Radius: installation	in. (mm)	1.0	(25.4)
Bend Radius: repeated	in. (mm)	4.0	(101.6)
Bending Moment	ft-lb (N-m)	0.5	(0.68)
Weight	lb/ft (kg/m)	0.068	(0.10)
Tensile Strength	lb (kg)	160	(72.6)
Flat Plate Crush	lb/in. (kg/mm)	40	(0.71)

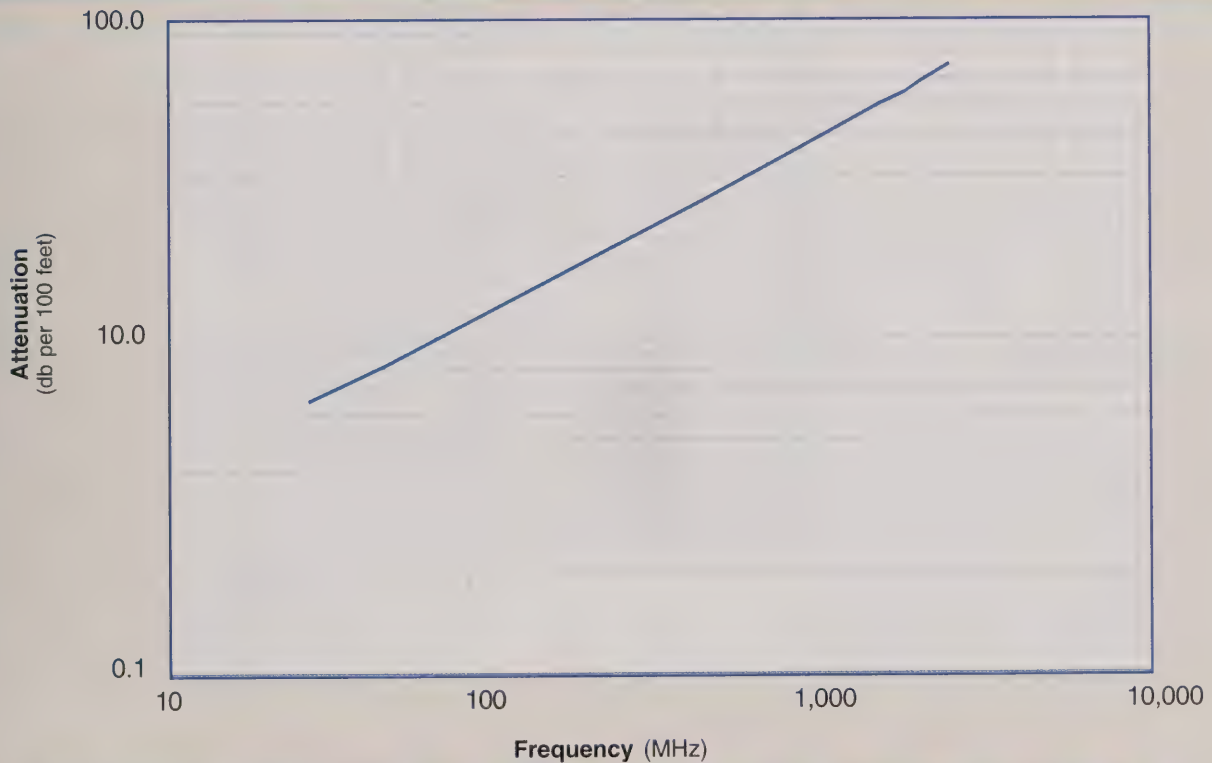
Environmental Specifications

Performance Property	°F	°C
Installation Temperature Range	-40/+185	-40/+85
Storage Temperature Range	-94/+185	-70/+185
Operating Temperature Range	-40/+185	-40/+85

Electrical Specifications

Performance Property	Units	US	(metric)
Max Operating Frequency	GHz	2.5	
Velocity of Propagation	%	85	
Dielectric Constant	NA	1.38	
Time Delay	nS/ft (nS/m)	1.20	(3.92)
Impedance	ohms	75	
Capacitance	pF/ft (pF/m)	15.9	(52.3)
Inductance	uH/ft (uH/m)	0.090	(0.29)
Shielding Effectiveness	dB	>90	
DC Resistance			
Inner Conductor	ohms/1000ft (/km)	5.36	(17.6)
Outer Conductor	ohms/1000ft (/km)	2.21	(7.3)
Voltage Withstand	Volts DC	2000	
Jacket Spark	Volts RMS	5000	
Peak Power	kW	10	

Attenuation vs. Frequency (typical)



Frequency (MHz)	30	50	150	220	450	900	1500	1800	2000	2500
Attenuation dB/100 ft	0.6	0.8	1.5	1.8	2.6	3.7	4.9	5.4	5.7	6.4
Attenuation dB/100 m	2.1	2.7	4.8	5.8	8.4	12.1	16.0	17.6	18.7	21.1
Avg. Power kW	2.99	2.31	1.32	1.08	0.74	0.52	0.39	0.35	0.33	0.30

Calculate Attenuation =

$(0.115570) \cdot \sqrt{\text{FMHz}} + (0.000260) \cdot \text{FMHz}$ (interactive calculator available at <http://www.timesmicrowave/telecom>)

Attenuation:

VSWR=1.0 ; Ambient = +25°C (77°F)

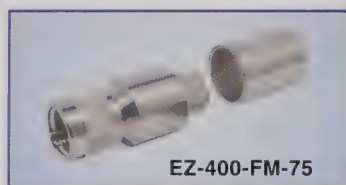
Power:

VSWR=1.0; Ambient = +40°C; Inner Conductor = 100°C (212°F); Sea Level; dry air; atmospheric pressure; no solar loading

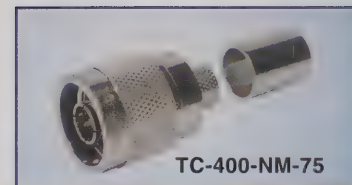
TIMES MICROWAVE SYSTEMS

A Smiths Group plc company

LMR-400-75 Ohm Flexible Low Loss Coaxial Cable



EZ-400-FM-75



TC-400-NM-75

Connectors

Interface	Description	Part Number	Stock Code	VSWR** Freq. (GHz)	Coupling Nut	Inner Contact Attach	Outer Contact Attach	Finish* Body /Pin	Length in (mm)	Width in (mm)	Weight lb (g)
F Male	Straight Plug	EZ-400-FM-75	3190-952	<1.25:1 (2.5)	Knurl	Spring Finger	Crimp	NG	1.7 (43.2)	0.56 (14.2)	0.002 (9.1)
N Male	Straight Plug	TC-400-NM-75	3190-389	<1.25:1 (2.5)	Knurl	Solder	Crimp	NG	1.5 (38.1)	0.83 (21.1)	0.90 (40.8)

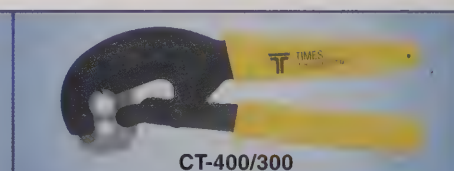
* Finish metals: N=Nickel, S=Silver, G=Gold, SS=Stainless Steel, A=Alballoy **VSWR spec based on 3 foot cable with a connector pair



HX-4



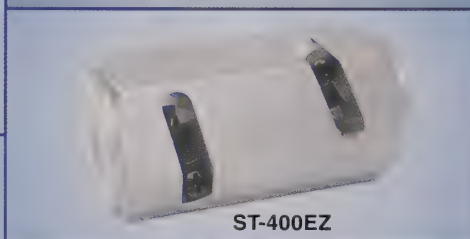
Y1719



CT-400/300



CR-400



ST-400EZ



DBT-01



CCT-01



TK-400EZ

Install Tools

Type	Part Number	Stock Code	Description
Crimp Tool	HX-4	3190-200	Crimp Handle
Crimp Dies	Y1719	3190-202	.429" Hex Dies
Crimp Tool	CT-400/300	3190-666	Crimp tool for LMR 400 connectors
Crimp Rings	CR-400	3190-830	Crimp rings for TC/EZ-400 connectors (package of 10)
Strip Tool	ST-400EZ	3190-401	For Crimp Connectors
Deburr Tool	DBT-01	3190-406	Removes center conductor rough edges
Cutting Tool	CCT-01	3190-1544	Cable end flush cut tool
Replacement Blades	RB-01	3190-1609	Replacement blades for cutting tool
Tool Kit	TK-400EZ	3190-1602	Tool kit for LMR-400 Crimp Connectors (includes CCT-01, ST-400EZ, CT-400/300, DBT-01, Tool Pouch)



Hardware Accessories

Type	Part Number	Stock Code	Description
Ground Kit	GK-S400T	GK-S400T	Standard Grounding Kit (each)
Hoisting Grip	HG-400T	HG-400T	Laced Type (each)

TIMES MICROWAVE SYSTEMS

A Smiths Group plc company

LMR-600-75 Ohm Flexible Low Loss Coaxial Cable

Ideal for...

- Video Applications-CCTV, CATV, baseband or broadband
- In-Building Feeder Runs
- Any 75 ohm Wireless Application requiring an easily routed, low loss RF cable

• **LMR® -75** standard is a UV Resistant Polyethylene jacketed cable designed for 20-year service outdoor use. The bending and handling characteristics are significantly better than any smooth wall or corrugated hard-line cables.

• **Flexibility** and bendability are hallmarks of the LMR-600-75 cable design. The flexible outer conductor enables the tightest bend radius available for any cable of similar size and performance.

• **Low Loss** is another hallmark feature of LMR-600-75. Size for size LMR-75 has the lowest loss of any flexible cable and comparable loss to semirigid hard-line cables.

• **RF Shielding** is 50 dB greater than typical single shielded coax (40 dB). The multi-ply bonded foil outer conductor is rated conservatively at > 90 dB (i.e. >180 dB between two adjacent cables).

• **Weatherability:** LMR-600-75 cables designed for outdoor exposure incorporate the best materials for UV resistance and have life expectancy in excess of 20 years.

• **Connectors:** Standard available connectors include type-N and type-F male plug with 75 ohm interface. Most LMR-75 connectors are the EZ install type with crimp outer and non-solder center contact attachment.

• **Cable Assemblies:** All LMR-600-75 cable types are available as pre-terminated cable assemblies. Refer to the section on FlexTech for further details.



Part Description

Part No.	Application	Jacket	Color	Stock Code
LMR-600-75	Indoor/Outdoor	PE	Black	54148

Construction Specifications

Description	Material	In.	(mm)
Inner Conductor	Solid BCCAI	0.108	(2.74)
Dielectric	Foam PE	0.455	(11.56)
Outer Conductor	Aluminum Tape	0.461	(11.71)
Overall Braid	Tinned Copper	0.490	(12.45)
Jacket	Black PE	0.590	(14.99)

Mechanical Specifications

Performance Property	Units	US	(metric)
Bend Radius: installation	in. (mm)	1.5	(38.1)
Bend Radius: repeated	in. (mm)	6.0	(152.4)
Bending Moment	ft-lb (N-m)	2.75	(3.73)
Weight	lb/ft (kg/m)	0.131	(0.20)
Tensile Strength	lb (kg)	350	(158.9)
Flat Plate Crush	lb/in. (kg/mm)	80	(1.07)

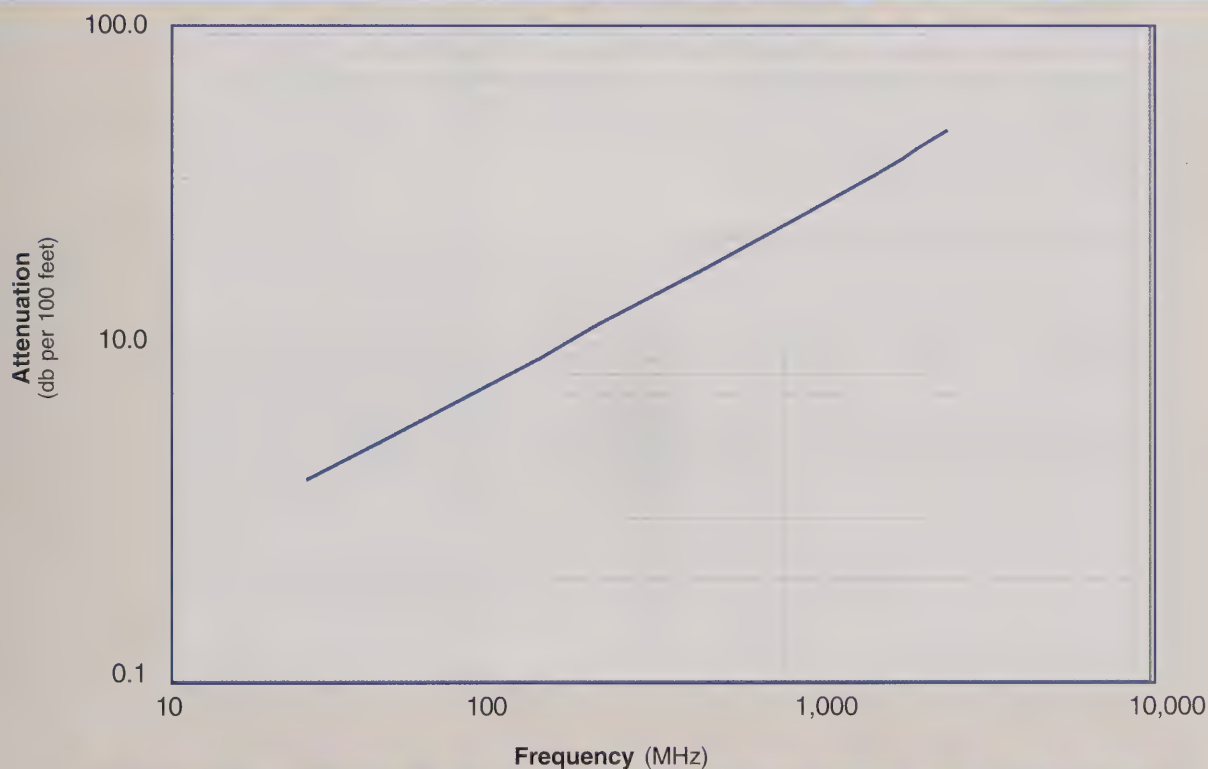
Environmental Specifications

Performance Property	°F	°C
Installation Temperature Range	-40/+185	-40/+85
Storage Temperature Range	-94/+185	-70/+185
Operating Temperature Range	-40/+185	-40/+85

Electrical Specifications

Performance Property	Units	US	(metric)
Max Operating Frequency	GHz	2.5	
Velocity of Propagation	%	87	
Dielectric Constant	NA	1.32	
Time Delay	nS/ft (nS/m)	1.17	(3.83)
Impedance	ohms	75	
Capacitance	pF/ft (pF/m)	15.6	(51.1)
Inductance	uH/ft (uH/m)	0.088	(0.29)
Shielding Effectiveness	dB	>90	
DC Resistance			
Inner Conductor	ohms/1000ft (/km)	1.37	(4.5)
Outer Conductor	ohms/1000ft (/km)	1.2	(3.9)
Voltage Withstand	Volts DC	4000	
Jacket Spark	Volts RMS	8000	
Peak Power	kW	40	

Attenuation vs. Frequency (typical)



Frequency (MHz)	30	50	150	220	450	900	1500	1800	2000	2500
Attenuation dB/100 ft	0.4	0.5	0.9	1.1	1.6	2.3	3.1	3.5	3.7	4.2
Attenuation dB/100 m	1.3	1.7	3.0	3.6	5.3	7.7	10.2	11.4	12.1	13.7
Avg. Power kW	4.77	3.67	2.08	1.70	1.16	0.80	0.60	0.54	0.51	0.45

Calculate Attenuation =

$(0.070590) \cdot \sqrt{\text{FMHz}} + (0.000260) \cdot \text{FMHz}$ (interactive calculator available at <http://www.timesmicrowave/telecom>)

Attenuation:

VSWR=1.0 ; Ambient = +25°C (77°F)

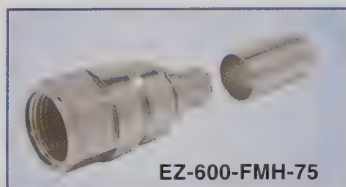
Power:

VSWR=1.0; Ambient = +40°C; Inner Conductor = 100°C (212°F); Sea Level; dry air; atmospheric pressure; no solar loading

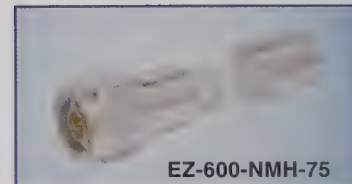
TIMES MICROWAVE SYSTEMS

A Smiths Group plc company

LMR-600-75 Ohm Flexible Low Loss Coaxial Cable



EZ-600-FMH-75

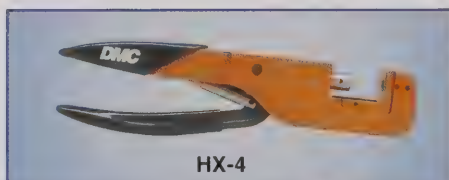


EZ-600-NMH-75

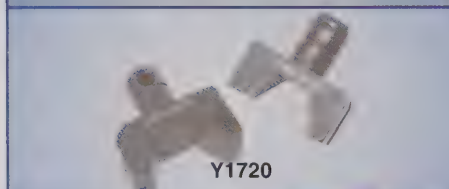
Connectors

Interface	Description	Part Number	Stock Code	VSWR** Freq. (GHz)	Coupling Nut	Inner Contact Attach	Outer Contact Attach	Finish* Body /Pin	Length in (mm)	Width in (mm)	Weight lb (g)
F Male	Straight Plug	EZ-600-FMH-75	3190-1619	<1.25:1 (2.5)	Hex	Spring Finger	Crimp	NG	1.7 (43.2)	0.56 (14.2)	0.112 (50.8)
N Male	Straight Plug	EZ-600-NMH-75	3190-1610	<1.25:1 (2.5)	Hex	Spring Finger	Crimp	NG	2.1 (53.3)	0.83 (21.1)	0.166 (75.3)

* Finish metals: N=Nickel, S=Silver, G=Gold, SS=Stainless Steel, A=Alballoy **VSWR spec based on 3 foot cable with a connector pair



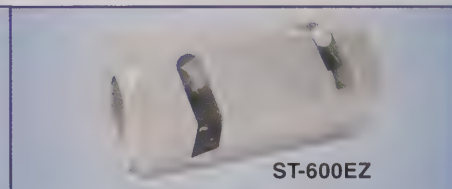
HX-4



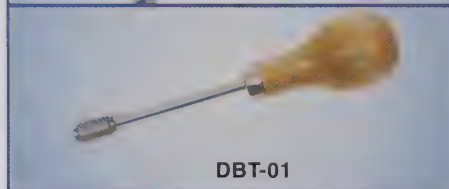
Y1720



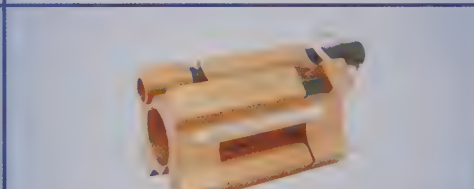
CR-600



ST-600EZ



DBT-01



GST-600A



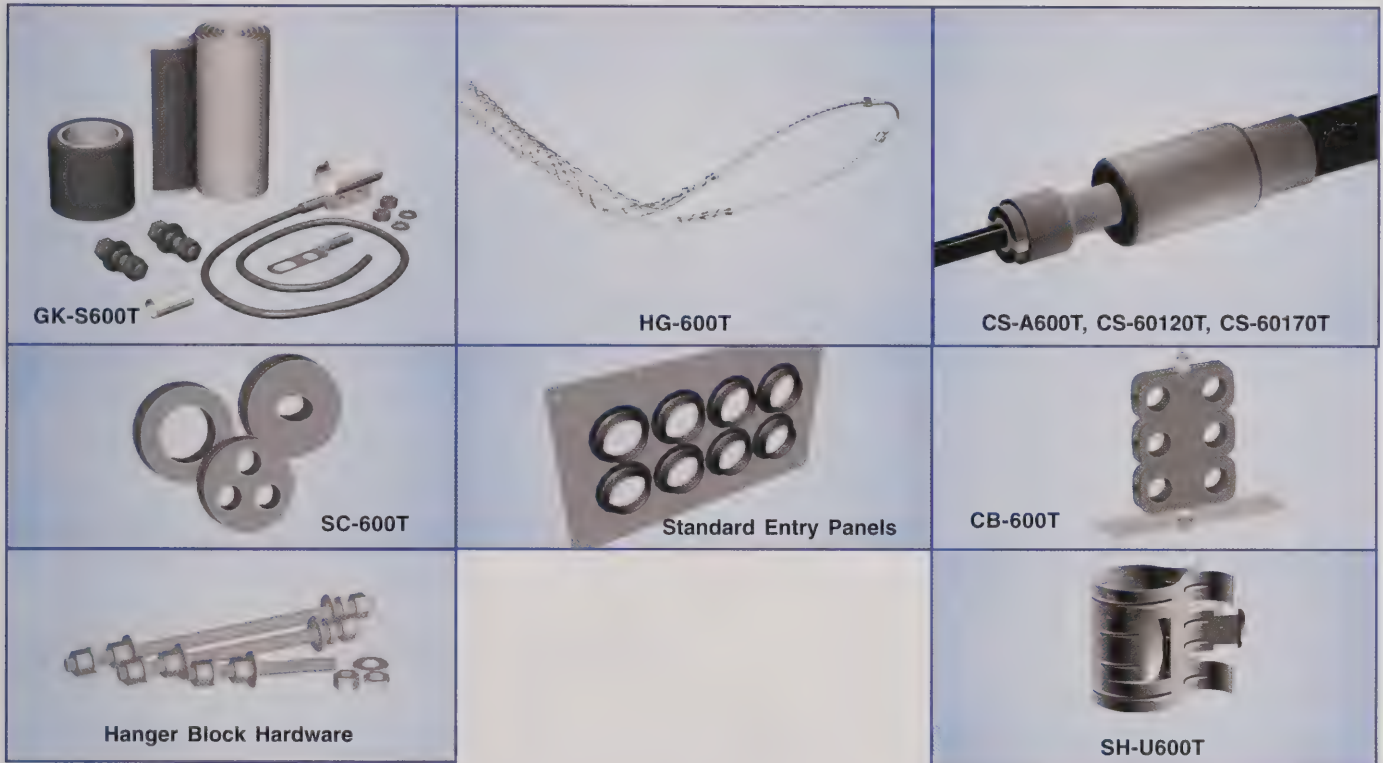
CCT-01



TK-600EZ

Install Tools

Type	Part Number	Stock Code	Description
Crimp Tool	HX-4	3190-200	Crimp Handle
Crimp Dies	Y1720	3190-203	.610" Hex Dies
Crimp Rings	CR-600	3190-831	Crimp Rings for TC/EZ-600 connectors (pkg of 10)
Strip Tool	ST-600EZ	3190-310	For Crimp Style Connectors
Deburr Tool	DBT-01	3190-406	Removes center conductor rough edges
Midspan Strip Tool	GST-600A	3190-1051	For ground strap attachment
Cutting Tool	CCT-01	3190-1544	Cable end flush cut tool
Replacement Blades	RB-01	3190-1609	Replacement blades for cutting tool
Tool Kit	TK-600EZ	3190-1602	Tool kit for LMR-600 Crimp Connectors (includes CCT-01, ST-600EZ, HX-4, Y1720, DBT-01, Tool Pouch)



Hardware Accessories

Type	Part Number	Stock Code	Description
Ground Kit	GK-S600T	GK-S600T	Standard Grounding Kit (each)
Hoisting Grip	HG-600T	HG-600T	Split/Laced Type (each)
Cold Shrink	CS-A600T	CS-A600T	Cable to Antenna Junction (each)
Cold Shrink	CS-60120T	CS-60120T	LMR-600 to -1200 Junction (each)
Cold Shrink	CS-60170T	CS-60170T	LMR-600 to -1700 Junction (each)
Stand. Entry Port Cushion	SC-600T	SC-600T	Three Cables (each)
Standard Entry Panels			Full Range of Port Styles/Combinations Available
Hanger Blocks	CB-600T	CB-600T	Dual Cable Support Block (kit of 10)
Hanger Block Supporting Hardware			Complete Range of Supporting Hardware & Adapters Available
Snap-In Hangers	SH-U600T	SH-U600T	Snap-In Hangers (Kit of 10)

TIMES MICROWAVE SYSTEMS

A Smiths Group plc company

TCOM-195 Low Loss Low Passive Intermod Coax

Ideal for...

- -155 dBc Intermodulation Distortion
- Low Loss UHF/Microwave Interconnect
- Wireless Base Station Interconnect
- Flexible for Easy Routing

• **TCOM®** standard is a UV Resistant Polyethylene jacketed cable designed for 20-year service outdoor use. The bending and handling characteristics are significantly better than any air-dielectric and corrugated hard-line cables. **TCOM® - FR** is a non-halogen (non-toxic), low smoke, fire retardant cable designed for in-building runs that can be routed anywhere except air handling plenums. TCOM-FR has a UL/NEC & CSA rating of 'CMR/MPR' and 'FT4' respectively.

Flexibility and bendability are hallmarks of the TCOM-195 cable design. The flexible outer conductor enables the tightest bend radius available for any cable of similar size and performance.

Low Loss is another hallmark feature of TCOM-195. Size for size LMR has the lowest loss of any flexible cable and comparable loss to semirigid hard-line cables.

Passive Intermod is lower than -155 dBc exceed the performance levels for most wireless applications.

RF Shielding is 60 dB greater than typical single shielded coax (40 dB). The multi-ply bonded foil outer conductor is rated conservatively at > 100 dB (i.e. >200 dB between two adjacent cables).

Weatherability: TCOM-195 cables designed for outdoor exposure incorporate the best materials for UV resistance and have life expectancy in excess of 20 years.

Connectors: A wide variety of connectors are available for TCOM-195 cable, including all common interface types, reverse polarity, and a choice of solder or non-solder center pins. Most LMR connectors employ crimp outer attachment using standard hex crimp sizes.

Cable Assemblies: All TCOM-195 cable types are available as pre-terminated cable assemblies. Refer to the section on FlexTech for further details.

Part Description					Stock
Part No.	Application	Jacket	Color	Code	
TCOM-195	Outdoor	PE	Black	55021	
TCOM-195-FR	Indoor-Riser CMR	FRPE	Black	55012	

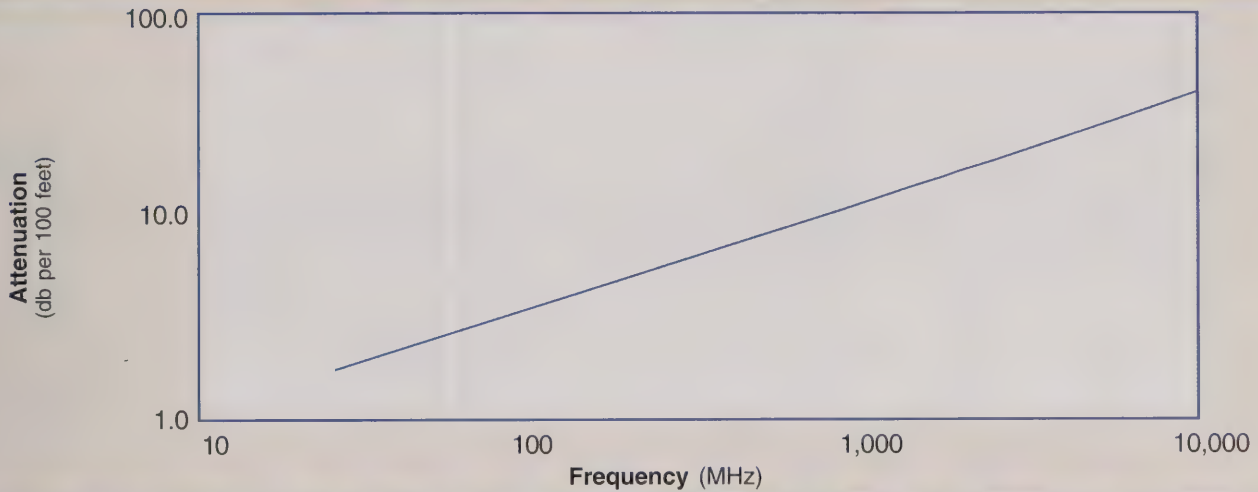
Construction Specifications			
Description	Material	In.	(mm)
Inner Conductor	Solid BC	0.037	(0.94)
Dielectric	Foam PE	0.110	(2.79)
Outer Conductor	SPC Strip Braid	0.120	(3.05)
Overall Braid	TC Braid over Al tape	0.148	(3.76)
Jacket	(see table above)	0.195	(4.95)

Mechanical Specifications			
Performance Property	Units	US	(metric)
Bend Radius: installation	in. (mm)	0.5	(12.7)
Bend Radius: repeated	in. (mm)	2	(50.8)
Bending Moment	ft-lb (N-m)	0.2	(0.27)
Weight	lb/ft (kg/m)	0.035	(0.05)
Tensile Strength	lb (kg)	40	(18.2)
Flat Plate Crush	lb/in. (kg/mm)	15	(0.27)

Environmental Specifications			
Performance Property	°F	°C	
Installation Temperature Range	-40/+185	-40/+85	
Storage Temperature Range	-94/+185	-70/+185	
Operating Temperature Range	-40/+185	-40/+85	

Electrical Specifications			
Performance Property	Units	US	(metric)
Cutoff Frequency	GHz	41	
Velocity of Propagation	%	80	
Dielectric Constant	NA	1.56	
Time Delay	nS/ft (nS/m)	1.27	(4.17)
Impedance	ohms	50	
Capacitance	pF/ft (pF/m)	25.4	(83.3)
Inductance	uH/ft (uH/m)	0.064	(0.21)
Shielding Effectiveness	dB	>100	
DC Resistance			
Inner Conductor	ohms/1000ft (/km)	7.6	(24.9)
Outer Conductor	ohms/1000ft (/km)	2.99	(9.8)
Voltage Withstand	Volts DC	1000	
Jacket Spark	Volts RMS	3000	
Peak Power	kW	2.5	
Passive Intermod	dBc	-155	

Attenuation vs. Frequency (typical)



Frequency (MHz)	30	50	150	220	450	900	1500	1800	2000	2500	5800	10,000
Attenuation dB/100 ft	1.8	2.3	4.0	4.9	7.0	10.1	13.1	14.5	15.3	17.2	27.2	36.8
Attenuation dB/100 m	5.8	7.5	13.1	16.0	23.0	33.0	43.1	47.5	50.2	56.5	89.1	120.7
Avg. Power kW	0.91	0.71	0.40	0.33	0.23	0.16	0.12	0.11	0.10	0.09	0.06	0.04

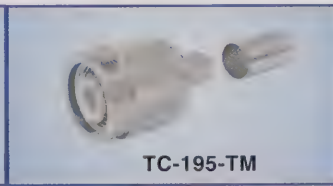
Calculate Attenuation = $(0.321011) \cdot \sqrt{\text{FMHz}} + (0.000469) \cdot \text{FMHz}$ (interactive calculator available at <http://www.timesmicrowave/telecom>)
 Attenuation: VSWR=1.0; Ambient = +25°C (77°F) Power: VSWR=1.0; Ambient = +40°C; Inner Conductor = 100°C (212°F);
 Sea Level; dry air; atmospheric pressure; no solar loading



TC-195-NM



TC-195-SM

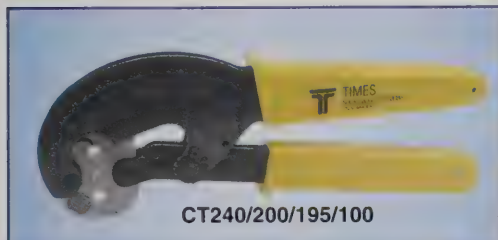


TC-195-TM

Connectors

Interface	Description	Part Number	Stock Code	VSWR** Freq. (GHz)	Coupling Nut	Inner Contact Attach	Outer Contact Attach	Finish* Body /Pin	Length in (mm)	Width in (mm)	Weight lb (g)
N male	Straight Plug	TC-195-NM	3190-224	<1.25:1 (25)	Knurl	Solder	Crimp	SG	15 (38.1)	0.75 (19.1)	0.073 (33.1)
SMA male	Straight Plug	TC-195-SM	3190-1551	<1.25:1 (25)	Hex	Solder	Crimp	SS/G	10 (25.4)	0.32 (8.1)	0.015 (6.8)
TNC male	Straight Plug	TC-195-TM	3190-1552	<1.25:1 (25)	Knurl	Solder	Crimp	SG	14 (35.6)	0.59 (15.0)	0.045 (20.4)

* Finish metals: N=Nickel, S=Silver, G=Gold, SS=Stainless Steel, A=Alballoy **VSWR spec based on 3 foot cable with a connector pair



CT240/200/195/100



CCT-01

Accessories

Type	Part Number	Stock Code	Description
Crimp Tool	CT-240/200/195/100	3190-667	Crimp tool for LMR-195 connectors
Cutting Tool	CCT-01	3190-1544	Cable and flush cut tool
Replacement Blades	RB-01	3190-1609	Replacement blades for cutting tool

TIMES MICROWAVE SYSTEMS

A Smiths Group plc company

TCOM-200

Low Loss Low Passive Intermod Coax

Ideal for...

- -155 dBc Intermodulation Distortion
- Low Loss UHF/Microwave Interconnect
- Wireless Base Station Interconnect
- Flexible for Easy Routing



• **TCOM**® standard is a UV Resistant Polyethylene jacketed cable designed for 20-year service outdoor use. The bending and handling characteristics are significantly better than air-dielectric and corrugated hard-line cables.

TCOM®-FR is a non-halogen (non-toxic), low smoke, fire retardant cable designed for in-building runs that can be routed anywhere except air handling plenums. TCOM-FR has a UL/NEC & CSA rating of 'CMR/MPR' and 'FT4' respectively.

Flexibility and bendability are hallmarks of the TCOM-200 cable design. The flexible outer conductor enables the tightest bend radius available for any cable of similar size and performance.

Low Loss is another hallmark feature of TCOM-200. Size for size LMR has the lowest loss of any flexible cable and comparable loss to semirigid hard-line cables.

Passive Intermod is lower than -155 dBc exceed the performance levels for most wireless applications..

RF Shielding is 60 dB greater than typical single shielded coax (40 dB). The multi-ply bonded foil outer conductor is rated conservatively at > 100 dB (i.e. >200 dB between two adjacent cables).

Weatherability: TCOM-200 cables designed for outdoor exposure incorporate the best materials for UV resistance and have life expectancy in excess of 20 years.

Connectors: A wide variety of connectors are available for TCOM-200 cable, including all common interface types, reverse polarity, and a choice of solder or non-solder center pins. Most LMR connectors employ crimp outer attachment using standard hex crimp sizes.

Cable Assemblies: All TCOM-200 cable types are available as pre-terminated cable assemblies. Refer to the section on FlexTech for further details.

Part Description					Stock
Part No.	Application	Jacket	Color		Code
TCOM-200	Outdoor	PE	Black		55001
TCOM-200-FR	Indoor-Riser CMR	FRPE	Black		55022

Construction Specifications			
Description	Material	In.	(mm)
Inner Conductor	Solid BC	0.044	(1.12)
Dielectric	Foam PE	0.116	(2.95)
Outer Conductor	SPC Strip Braid	0.126	(3.20)
Overall Braid	TC Braid over Al tape	0.154	(3.91)
Jacket	(see table above)	0.195	(4.95)

Mechanical Specifications

Performance Property	Units	US	(metric)
Bend Radius: installation	in. (mm)	0.5	(12.7)
Bend Radius: repeated	in. (mm)	2	(50.8)
Bending Moment	ft-lb (N-m)	0.2	(0.27)
Weight	lb/ft (kg/m)	0.040	(0.06)
Tensile Strength	lb (kg)	40	(18.2)
Flat Plate Crush	lb/in. (kg/mm)	15	(0.27)

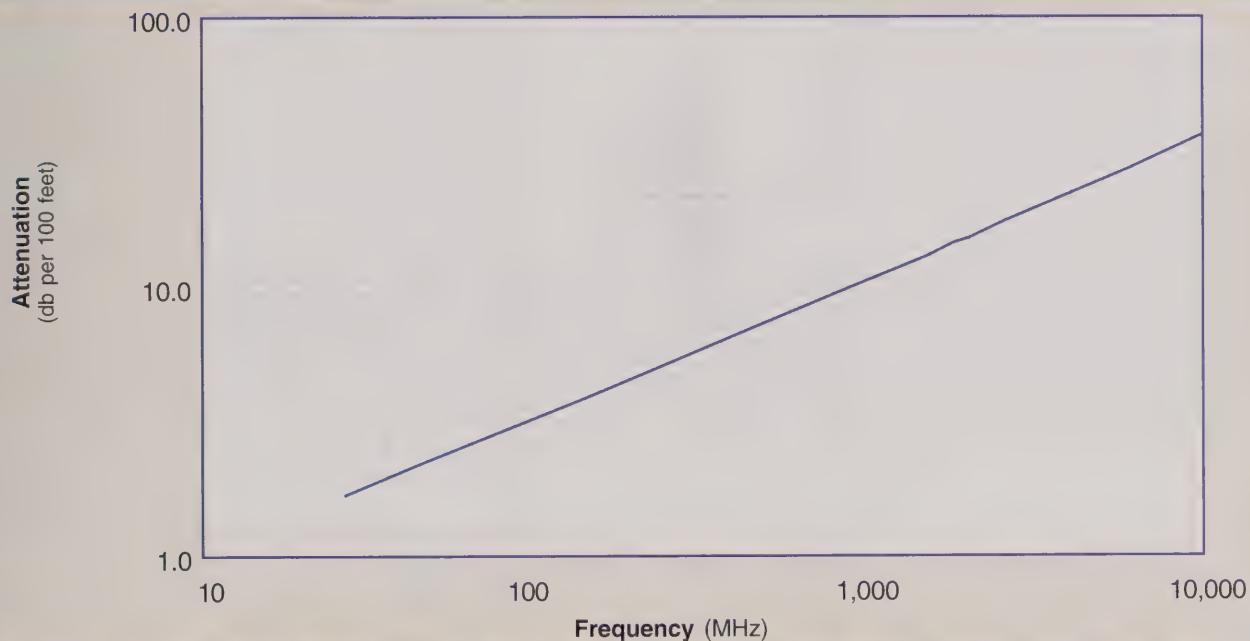
Environmental Specifications

Performance Property	°F	°C
Installation Temperature Range	-40/+185	-40/+85
Storage Temperature Range	-94/+185	-70/+185
Operating Temperature Range	-40/+185	-40/+85

Electrical Specifications

Performance Property	Units	US	(metric)
Cutoff Frequency	GHz	39	
Velocity of Propagation	%	83	
Dielectric Constant	NA	1.45	
Time Delay	nS/ft (nS/m)	1.22	(4.02)
Impedance	ohms	50	
Capacitance	pF/ft (pF/m)	24.5	(80.3)
Inductance	uH/ft (uH/m)	0.061	(0.20)
Shielding Effectiveness	dB	>100	
DC Resistance			
Inner Conductor	ohms/1000ft (/km)	5.36	(17.6)
Outer Conductor	ohms/1000ft (/km)	3.27	(10.7)
Voltage Withstand	Volts DC	1000	
Jacket Spark	Volts RMS	3000	
Peak Power	kW	2.5	
Passive Intermod	dBc	-155	

Attenuation vs. Frequency (typical)



Frequency (MHz)	30	50	150	220	450	900	1500	1800	2000	2500	5800	10,000
Attenuation dB/100 ft	1.7	2.2	3.8	4.6	6.6	9.4	12.3	13.5	14.2	16.0	25.0	33.7
Attenuation dB/100 m	5.5	7.1	12.4	15.0	21.6	30.9	40.2	44.2	46.7	52.5	82.2	110.5
Avg. Power kW	1.08	0.84	0.48	0.39	0.27	0.19	0.15	0.13	0.13	0.11	0.07	0.05

Calculate Attenuation = $(0.303670) \cdot \sqrt{\text{FMHz}} + (0.000331) \cdot \text{FMHz}$ (interactive calculator available at <http://www.timesmicrowave/telecom>)
 Attenuation: VSWR=1.0; Ambient = +25°C (77°F) Power: VSWR=1.0; Ambient = +40°C; Inner Conductor = 100°C (212°F);
 Sea Level; dry air; atmospheric pressure; no solar loading

TIMES MICROWAVE SYSTEMS

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Connectors

Interface	Description	Part Number	Stock Code	VSWR** Freq. (GHz)	Coupling Nut	Inner Contact Attach	Outer Contact Attach	Finish* Body /Pin	Length in (mm)	Width in (mm)	Weight lb (g)
BNC male	Straight Plug	TC-200-BM	3190-225	<1.25:1 (2.5)	Knurl	Solder	Crimp	S/G	1.7 (43.2)	0.56 (14.2)	0.045 (20.4)
Mini-UHF	Straight Plug	TC-200-MUHF	3190-444	<1.25:1 (2.5)	Knurl	Solder	Crimp	NG	1.1 (27.9)	0.45 (11.4)	0.015 (6.8)
N male	Straight Plug	EZ-200-NM	3190-1475	<1.25:1 (8)	Knurl	Spring Fit	Crimp	S/G	1.5 (38.1)	0.75 (19.1)	0.073 (33.1)
N male	Straight Plug	TC-200-NM	3190-224	<1.25:1 (2.5)	Knurl	Solder	Crimp	S/G	1.5 (38.1)	0.75 (19.1)	0.073 (33.1)
N male	Reverse Polarity	TC-200-NM-RP	3190-959	<1.25:1 (2.5)	Knurl	Solder	Crimp	NG	1.5 (38.1)	0.75 (19.1)	0.073 (33.1)
SMA male	Straight Plug	TC-200-SM	3190-612	<1.25:1 (8)	Hex	Solder	Crimp	SS/G	1.0 (25.4)	0.32 (8.1)	0.015 (6.8)
SMA male	Reverse Polarity	TC-200-SM-RP	3190-327	<1.25:1 (2.5)	Hex	Solder	Crimp	SS/G	1.0 (25.4)	0.32 (8.1)	0.015 (6.8)
TNC male	Straight Plug	EZ-200-TM	3190-1266	<1.25:1 (2.5)	Knurl	Spring Fit	Crimp	S/G	1.4 (35.6)	0.59 (15.0)	0.045 (20.4)
TNC male	Straight Plug	TC-200-TMC	3190-240	<1.25:1 (2.5)	Knurl	Solder	Clamp	S/G	1.7 (43.2)	0.59 (15.0)	0.045 (20.4)
TNC male	Reverse Polarity	EZ-200-TM-RP	3190-792	<1.25:1 (2.5)	Knurl	Spring Fit	Crimp	A/G	1.4 (35.6)	0.32 (8.1)	0.045 (20.4)
TNC female	Straight Jack	TC-200-TF	3190-263	<1.25:1 (2.5)	NA	Solder	Crimp	NG	1.3 (33.0)	0.57 (14.5)	0.033 (15.0)
TNC female	Reverse Polarity	EZ-200-TF-RP	3190-793	<1.25:1 (2.5)	NA	Spring Fit	Crimp	A/G	1.3 (33.0)	0.57 (14.5)	0.033 (15.0)

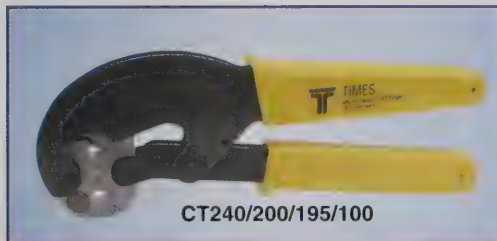
* Finish metals: N=Nickel, S=Silver, G=Gold, SS=Stainless Steel, A=Alballoy **VSWR spec based on 3 foot cable with a connector pair



GK-S200T

Hardware Accessories

Type	Part Number	Stock Code	Description
Ground Kit	GK-S200T	GK-S200T	Standard Ground Kit (each)



CT240/200/195/100

Install Tools



CCT-01

Type	Part Number	Stock Code	Description
Crimp Tool	CT-240/200/195/100	3190-667	Crimp tool for LMR 200 connectors
Cutting Tool	CCT-01	3190-1544	Cable end flush cut tool
Replacement Blades	RB-01	3190-1609	Replacement blades for cutting tool

TIMES MICROWAVE SYSTEMS

A Smiths Group plc company

TCOM-240

Low Loss Low Passive Intermod Coax

Ideal for...

- -155 dBc Intermodulation Distortion
- Low Loss UHF/Microwave Interconnect
- Wireless Base Station Interconnect
- Flexible for Easy Routing

• **TCOM**® standard is a UV Resistant Polyethylene jacketed cable designed for 20-year service outdoor use. The bending and handling characteristics are significantly better than air-dielectric and corrugated hard-line cables.

TCOM®-FR is a non-halogen (non-toxic), low smoke, fire retardant cable designed for in-building runs that can be routed anywhere except air handling plenums. TCOM-FR has a UL/NEC & CSA rating of 'CMR/MPR' and 'FT4' respectively.

TCOM®-PUR has a polyurethane outer jacket designed for multiple bending/flexing cycles in rugged tactical applications.

Flexibility and bendability are hallmarks of the TCOM-240 cable design. The flexible outer conductor enables the tightest bend radius available for any cable of similar size and performance.

Low Loss is another hallmark feature of TCOM-240. Size for size LMR has the lowest loss of any flexible cable and comparable loss to semirigid hard-line cables.

Passive Intermod is lower than -155 dBc exceed the performance levels for most wireless applications..

RF Shielding is 60 dB greater than typical single shielded coax (40 dB). The multi-ply bonded foil outer conductor is rated conservatively at > 100 dB (i.e. >200 dB between two adjacent cables).

Weatherability: TCOM-240 cables designed for outdoor exposure incorporate the best materials for UV resistance and have life expectancy in excess of 20 years.

Connectors: A wide variety of connectors are available for TCOM-240 cable, including all common interface types, reverse polarity, and a choice of solder or non-solder center pins. Most LMR connectors employ crimp outer attachment using standard hex crimp sizes.

Cable Assemblies: All TCOM-240 cable types are available as pre-terminated cable assemblies. Refer to the section on FlexTech for further details.

Part Description				Stock
Part No.	Application	Jacket	Color	Code
TCOM-240	Outdoor	PE	Black	55017
TCOM-240-FR	Indoor-Riser CMR	FRPE	Black	55023

Construction Specifications			
Description	Material	In.	(mm)
Inner Conductor	Solid BC	0.056	(1.42)
Dielectric	Foam PE	0.150	(3.81)
Outer Conductor	SPC Strip Braid	0.160	(4.06)
Overall Braid	TC Braid over Al tape	0.188	(4.78)
Jacket	(see table above)	0.240	(6.10)

Mechanical Specifications

Performance Property	Units	US	(metric)
Bend Radius: installation	in. (mm)	0.75	(19.1)
Bend Radius: repeated	in. (mm)	2.5	(63.5)
Bending Moment	ft-lb (N-m)	0.25	(0.34)
Weight	lb/ft (kg/m)	0.045	(0.07)
Tensile Strength	lb (kg)	80	(36.3)
Flat Plate Crush	lb/in. (kg/mm)	20	(0.36)

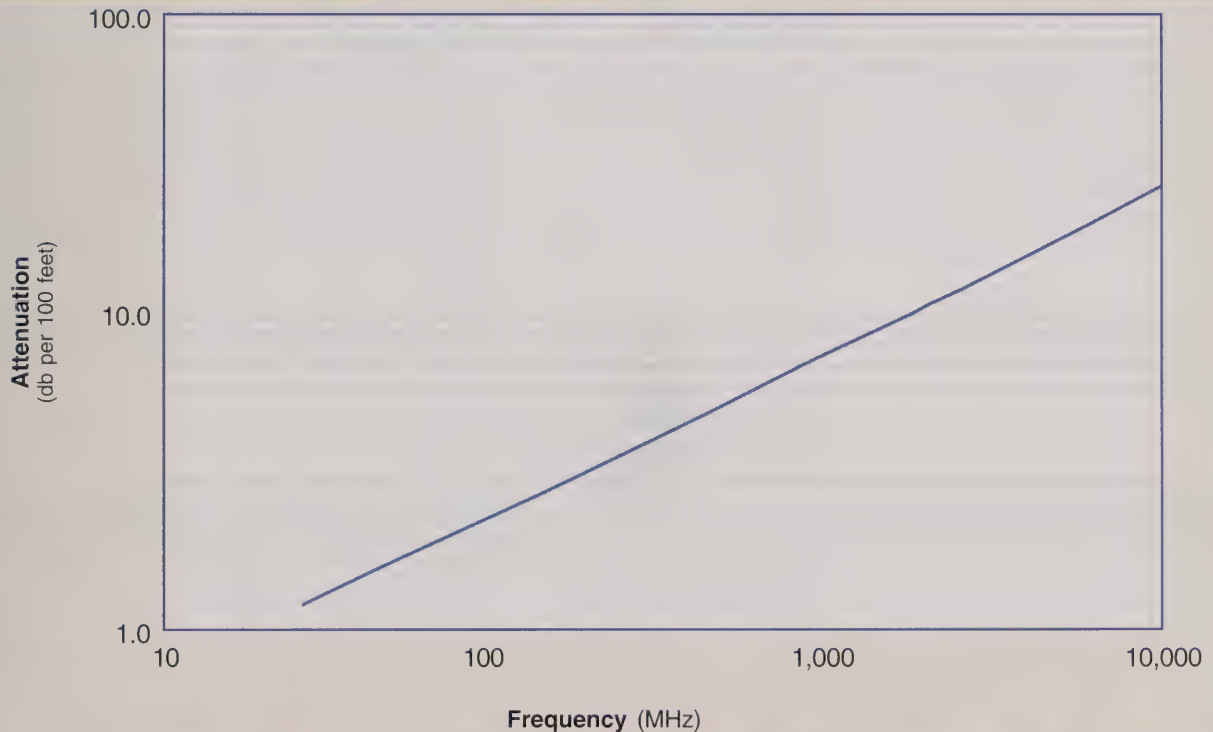
Environmental Specifications

Performance Property	°F	°C
Installation Temperature Range	-40/+185	-40/+85
Storage Temperature Range	-94/+185	-70/+185
Operating Temperature Range	-40/+185	-40/+85

Electrical Specifications

Performance Property	Units	US	(metric)
Cutoff Frequency	GHz	31	
Velocity of Propagation	%	84	
Dielectric Constant	NA	1.42	
Time Delay	nS/ft (nS/m)	1.21	(3.97)
Impedance	ohms	50	
Capacitance	pF/ft (pF/m)	24.2	(79.4)
Inductance	uH/ft (uH/m)	0.060	(0.20)
Shielding Effectiveness	dB	>100	
DC Resistance			
Inner Conductor	ohms/1000ft (/km)	3.2	(10.5)
Outer Conductor	ohms/1000ft (/km)	2.62	(8.6)
Voltage Withstand	Volts DC	1500	
Jacket Spark	Volts RMS	5000	
Peak Power	kW	5.6	
Passive Intermod	dBc	-155	

Attenuation vs. Frequency (typical)



Frequency (MHz)	30	50	150	220	450	900	1500	1800	2000	2500	5800	10,000
Attenuation dB/100 ft	1.3	1.6	2.9	3.5	5.0	7.2	9.4	10.3	10.9	12.3	19.4	26.2
Attenuation dB/100 m	4.2	5.4	9.4	11.4	16.4	23.5	30.7	33.9	35.8	40.3	63.6	86.0
Avg. Power kW	1.58	1.22	0.70	0.57	0.40	0.28	0.21	0.19	0.18	0.16	0.10	0.07

Calculate Attenuation =

$(0.229148) \cdot \sqrt{\text{FMHz}} + (0.000331) \cdot \text{FMHz}$ (interactive calculator available at <http://www.timesmicrowave/telecom>)

Attenuation:

VSWR=1.0 ; Ambient = +25°C (77°F)

Power:

VSWR=1.0; Ambient = +40°C; Inner Conductor = 100°C (212°F); Sea Level; dry air; atmospheric pressure; no solar loading

TIMES MICROWAVE SYSTEMS

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TCOM-240

Low Loss Low Passive Intermod Coax



Connectors

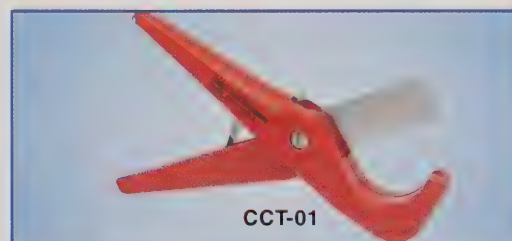
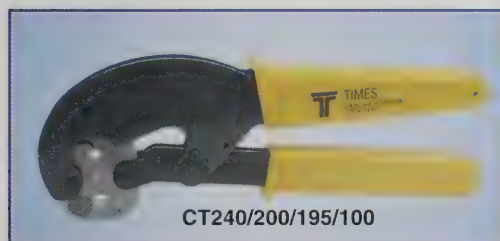
Interface	Description	Part Number	Stock Code	VSWR** Freq. (GHz)	Coupling Nut	Inner Contact Attach	Outer Contact Attach	Finish* Body /Pin	Length in (mm)	Width in (mm)	Weight lb (g)
N Male	Straight Plug	EZ-240-NM	3190-1127	<1.25:1 (2.5)	Knurl	Spring Finger	Crimp	NG	1.5 (38.1)	0.78 (19.8)	0.086 (39.0)
N Male	Straight Plug	TC-240-NMH	3190-382	<1.25:1 (2.5)	Hex	Solder	Crimp	NS	1.5 (38)	0.75 (19.1)	0.086 (39.0)
N Male	Straight Plug	TC-240-NMC	3190-244	<1.25:1 (2.5)	Knurl	Solder	Clamp	S/G	1.5 (38)	0.75 (19.1)	0.082 (37.2)
N Male	Right Angle	TC-240-NM-RA(A)	3190-868	<1.35:1 (2.5)	Hex	Solder	Crimp	A/G	1.3 (33)	1.14 (29.1)	0.105 (47.6)
N Female	Panel Jack	TC-240-NF-BHF(A)	3190-866	<1.25:1 (2.5)	NA	Solder	Crimp	A/G	1.7 (44)	0.88 (22.2)	0.115 (52.2)
N Female	Bulkhead Jack	TC-240-NF-BH	3190-419	<1.25:1 (2.5)	NA	Solder	Clamp	A/G	1.8 (46)	0.88 (22.4)	0.145 (65.8)
BNC Male	Straight Plug	TC-240-BMC	3190-242	<1.25:1 (2.5)	Knurl	Solder	Clamp	S/G	1.7 (43)	0.56 (14.2)	0.040 (18.1)
BNC Male	Straight Plug	TC-240-BM (A)	3190-867	<1.25:1 (2.5)	Knurl	Solder	Crimp	A/G	1.7 (43)	0.56 (14.2)	0.043 (19.5)
TNC Male	Straight Plug	EZ-240-TM	3190-1128	<1.25:1 (2.5)	Knurl	Spring Finger	Crimp	NG	1.4 (34.3)	0.59 (15.0)	0.043 (19.5)
TNC Male	Straight Plug	TC-240-TM	3190-275	<1.25:1 (2.5)	Knurl	Solder	Crimp	NS	1.7 (43)	0.59 (15.0)	0.043 (19.5)
TNC Male	Right Angle	TC-240-TM-RA	3190-604	<1.35:1 (2.5)	Knurl	Solder	Crimp	NG	1.3 (33)	0.57 (14.5)	0.055 (24.9)
TNC Male	Reverse Polarity	EZ-240-TM-RP	3190-970	<1.25:1 (2.5)	Knurl	Spring Finger	Crimp	A/G	1.4 (36)	0.59 (15.0)	0.043 (19.5)
SMA Male	Straight Plug	TC-240-SM	3190-380	<1.25:1 (10)	Hex	Solder	Crimp	SS/G	1.0 (25)	0.32 (8.1)	0.016 (7.3)
SMA Male	Right Angle	TC-240-SM-RA	3190-381	<1.35:1 (6)	Hex	Solder	Crimp	SS/G	0.8 (20)	0.65 (16.5)	0.019 (8.6)
SMA Male	Reverse Polarity	TC-240-SM-RP	3190-326	<1.25:1 (2.5)	Hex	Solder	Crimp	SS/G	1.0 (25)	0.32 (8.1)	0.016 (7.3)
SMA Female	Bulkhead Jack	TC-240-SF-BH	3190-824	<1.25:1 (2.5)	NA	Solder	Crimp	SS/G	1.1 (29)	0.31 (7.9)	0.019 (8.6)
Mini-UHF	Straight Plug	TC-240-MUHF	3190-445	<1.25:1 (2.5)	Knurl	Solder	Crimp	NG	1.1 (28)	0.45 (11.4)	0.014 (6.4)

* Finish metals: N=Nickel, S=Silver, G=Gold, SS=Stainless Steel, A=Alballoy **VSWR spec based on 3 foot cable with a connector pair



Hardware Accessories

Type	Part Number	Stock Code	Description
Ground Kit	GK-S240T	GK-S240T	Standard Ground Kit (each)



Installation Tools

Type	Part Number	Stock Code	Description
Crimp Tool	CT-240/200/195/100	3190-667	Crimp tool for LMR 240 connectors
Cutting Tool	CCT-01	3190-1544	Cable end flush cut tool
Replacement Blades	RB-01	3190-1609	Replacement blades for cutting tool

TIMES MICROWAVE SYSTEMS

A Smiths Group plc company

TCOM-300

Low Loss Low Passive Intermod Coax

Ideal for...

- -155 dBc Intermodulation Distortion
- Low Loss UHF/Microwave Interconnect
- Wireless Base Station Interconnect
- Flexible for Easy Routing

• **TCOM** standard is a UV Resistant Polyethylene jacketed cable designed for 20-year service outdoor use. The bending and handling characteristics are significantly better than air-dielectric and corrugated hard-line cables.

TCOM - FR is a non-halogen (non-toxic), low smoke, fire retardant cable designed for in-building runs that can be routed anywhere except air handling plenums. TCOM-FR has a UL/NEC & CSA rating of 'CMR/MPR' and 'FT4' respectively.

TCOM - PUR has a polyurethane outer jacket designed for multiple bending/flexing cycles in rugged tactical applications.

Flexibility and bendability are hallmarks of the TCOM-300 cable design. The flexible outer conductor enables the tightest bend radius available for any cable of similar size and performance.

Low Loss is another hallmark feature of TCOM-300. Size for size LMR has the lowest loss of any flexible cable and comparable loss to semirigid hard-line cables.

Passive Intermod is lower than -155 dBc exceed the performance levels for most wireless applications..

RF Shielding is 60 dB greater than typical single shielded coax (40 dB). The multi-ply bonded foil outer conductor is rated conservatively at > 100 dB (i.e. >200 dB between two adjacent cables).

Weatherability: TCOM-300 cables designed for outdoor exposure incorporate the best materials for UV resistance and have life expectancy in excess of 20 years.

Connectors: A wide variety of connectors are available for TCOM-300 cable, including all common interface types, reverse polarity, and a choice of solder or non-solder center pins. Most LMR connectors employ crimp outer attachment using standard hex crimp sizes.

Cable Assemblies: All TCOM-300 cable types are available as pre-terminated cable assemblies. Refer to the section on FlexTech for further details.

Part Description				Stock
Part No.	Application	Jacket	Color	Code
TCOM-300	Outdoor	PE	Black	55011
TCOM-300-FR	Indoor-Riser CMR	FRPE	Black	55013

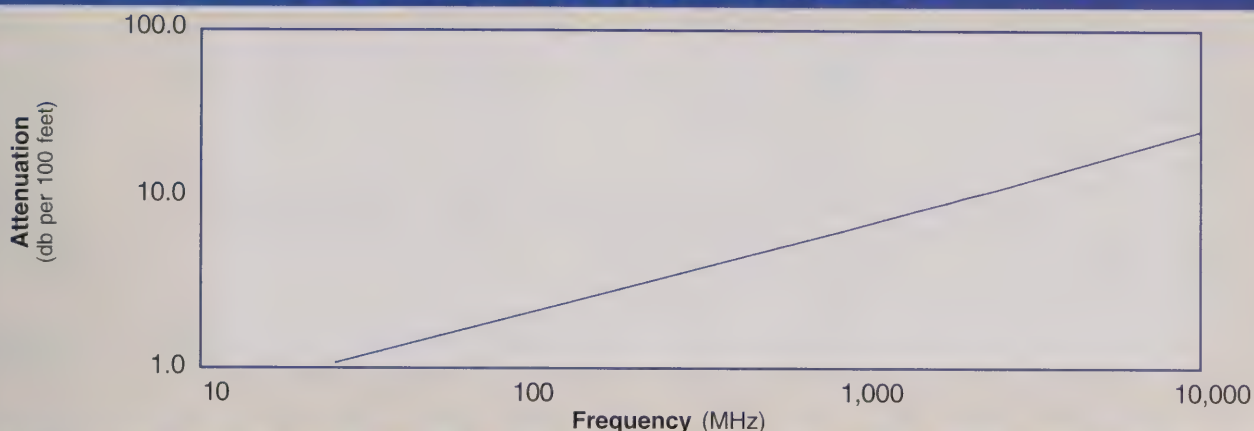
Construction Specifications			
Description	Material	In.	(mm)
Inner Conductor	Solid BC	0.070	(1.78)
Dielectric	Foam PE	0.190	(4.83)
Outer Conductor	SPC Strip Braid	0.200	(5.08)
Overall Braid	TC Braid over Al tape	0.234	(5.94)
Jacket	(see table above)	0.300	(7.62)

Mechanical Specifications			
Performance Property	Units	US	(metric)
Bend Radius: installation	in. (mm)	0.88	(22.2)
Bend Radius: repeated	in. (mm)	3.0	(76.2)
Bending Moment	ft-lb (N-m)	0.38	(0.52)
Weight	lb/ft (kg/m)	0.055	(0.08)
Tensile Strength	lb (kg)	120	(54.5)
Flat Plate Crush	lb/in. (kg/mm)	30	(0.54)

Environmental Specifications			
Performance Property	'F	'C	
Installation Temperature Range	-40/+185	-40/+85	
Storage Temperature Range	-94/+185	-70/+185	
Operating Temperature Range	-40/+185	-40/+85	

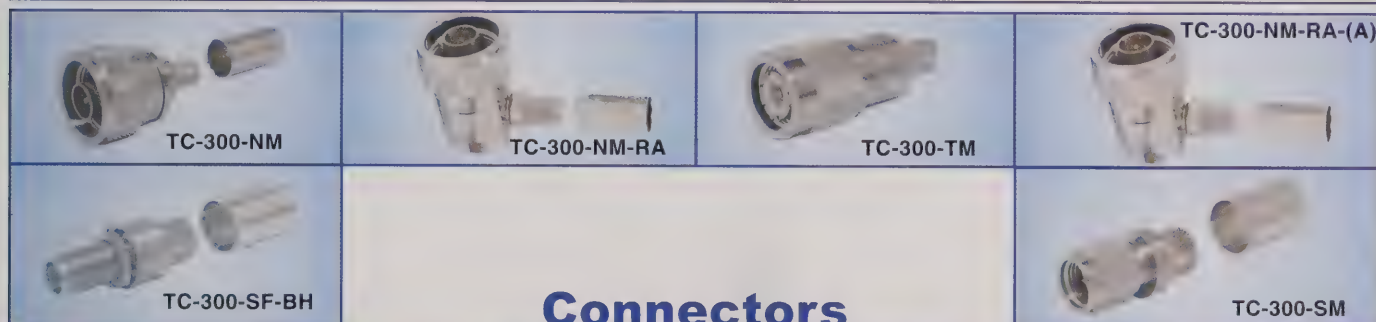
Electrical Specifications			
Performance Property	Units	US	(metric)
Cutoff Frequency	GHz	24.5	
Velocity of Propagation	%	85	
Dielectric Constant	NA	1.38	
Time Delay	nS/ft (nS/m)	1.20	(3.92)
Impedance	ohms	50	
Capacitance	pF/ft (pF/m)	23.9	(78.4)
Inductance	uH/ft (uH/m)	0.060	(0.20)
Shielding Effectiveness	dB	>100	
DC Resistance			
Inner Conductor	ohms/1000ft (/km)	2.12	(7.0)
Outer Conductor	ohms/1000ft (/km)	1.64	(5.4)
Voltage Withstand	Volts DC	2000	
Jacket Spark	Volts RMS	5000	
Peak Power	kW	10	
Passive Intermod	dBc	-155	

Attenuation vs. Frequency (typical)



Frequency (MHz)	30	50	150	220	450	900	1500	1800	2000	2500	5800	10,000
Attenuation dB/100 ft	1.1	1.4	2.4	3.0	4.3	6.1	8.0	8.8	9.3	10.5	16.7	22.7
Attenuation dB/100 m	3.5	4.6	8.0	9.7	14.0	20.1	26.3	29.0	30.7	34.6	54.8	74.5
Avg. Power kW	2.07	1.60	0.91	0.75	0.52	0.36	0.28	0.25	0.24	0.21	0.13	0.10

Calculate Attenuation = $(0.194337) \cdot \sqrt{\text{FMHz}} + (0.000327) \cdot \text{FMHz}$ (interactive calculator available at <http://www.timesmicrowave/telecom>)
 Attenuation: VSWR=1.0; Ambient = +25°C (77°F) Power: VSWR=1.0; Ambient = +40°C; Inner Conductor = 100°C (212°F);
 Sea Level; dry air; atmospheric pressure; no solar loading



Connectors

Interface	Description	Part Number	Stock Code	VSWR** Freq. (GHz)	Coupling Nut	Inner Contact Attach	Outer Contact Attach	Finish* Body /Pin	Length in (mm)	Width in (mm)	Weight lb (g)
N Male	Straight Plug	TC-300-NM	3190-498	<1.25:1 (6)	Knurl	Solder	Crimp	NS	1.6 (41)	0.85 (21.6)	0.074 (33.8)
N Male	Right Angle	TC-300-NM-RA	3190-499	<1.35:1 (2.5)	Knurl	Solder	Crimp	NS	1.5 (38)	0.85 (21.6)	0.101 (45.8)
TNC Male	Straight Plug	TC-300-TM	3190-500	<1.25:1 (2.5)	Knurl	Solder	Crimp	NS	1.7 (43)	0.59 (15.0)	0.050 (22.7)
SMA Male	Straight Plug	TC-300-SM	3190-501	<1.25:1 (2.5)	Hex	Solder	Crimp	SS/G	1.0 (25)	0.35 (8.9)	0.018 (8.2)
SMA Female	Bulkhead Jack	TC-300-SF-BH	3190-590	<1.25:1 (2.5)	NA	Solder	Crimp	SS/G	1.1 (28)	0.31 (7.9)	0.022 (10.0)

* Finish metals: N=Nickel, S=Silver, G=Gold, SS=Stainless Steel, A=Alballoy **VSWR spec based on 3 foot cable with a connector pair

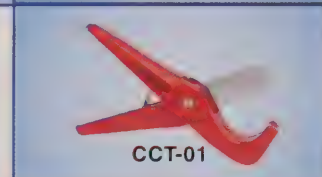
Hardware Accessories

Type	Part Number	Stock Code	Description
Ground Kit	GK-S300T	GK-S300T	Standard Ground Kit (each)



Install Tools

Type	Part Number	Stock Code	Description
Crimp Tool	CT-300/400	3190-666	Crimp tool for LMR-300 connectors
Cutting Tool	CCT-01	3190-1544	Cable end flush cut tool
Replacement Blades	RB-01	3190-1609	Replacement blades for cutting tool



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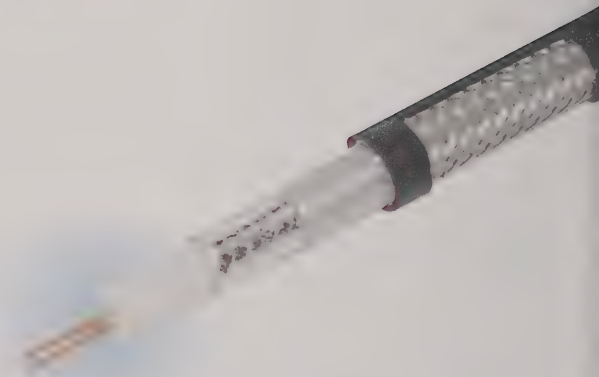
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TCOM-400

Low Loss Low Passive Intermod Coax

Ideal for...

- -155 dBc Intermodulation Distortion
- Low Loss UHF/Microwave Interconnect
- Wireless Base Station Interconnect
- Flexible for Easy Routing



• **TCOM®** standard is a UV Resistant Polyethylene jacketed cable designed for 20-year service outdoor use. The bending and handling characteristics are significantly better than air-dielectric and corrugated hard-line cables.

TCOM® - FR is a non-halogen (non-toxic), low smoke, fire retardant cable designed for in-building runs that can be routed anywhere except air handling plenums. TCOM-FR has a UL/NEC & CSA rating of 'CMR/MPR' and 'FT4' respectively.

TCOM® - PUR has a polyurethane outer jacket designed for multiple bending/flexing cycles in rugged tactical applications.

Flexibility and bendability are hallmarks of the TCOM-400 cable design. The flexible outer conductor enables the tightest bend radius available for any cable of similar size and performance.

Low Loss is another hallmark feature of TCOM-400. Size for size LMR has the lowest loss of any flexible cable and comparable loss to semirigid hard-line cables.

Passive Intermod is lower than -155 dBc exceed the performance levels for most wireless applications.

RF Shielding is 60 dB greater than typical single shielded coax (40 dB). The multi-ply bonded foil outer conductor is rated conservatively at > 100 dB (i.e. >200 dB between two adjacent cables).

Weatherability: TCOM-400 cables designed for outdoor exposure incorporate the best materials for UV resistance and have life expectancy in excess of 20 years.

Connectors: A wide variety of connectors are available for TCOM-400 cable, including all common interface types, reverse polarity, and a choice of solder or non-solder center pins. Most LMR connectors employ crimp outer attachment using standard hex crimp sizes.

Cable Assemblies: All TCOM-400 cable types are available as pre-terminated cable assemblies. Refer to the section on FlexTech for further details.

Part Description				Stock
Part No.	Application	Jacket	Color	Code
TCOM-400	Outdoor	PE	Black	55003
TCOM-400-FR	Indoor-Riser CMR	FRPE	Black	55016
TCOM-400-PUR	Indoor/Outdoor	PUR	Black	55015

Construction Specifications			
Description	Material	In.	(mm)
Inner Conductor	Solid BCCAI	0.108	(2.74)
Dielectric	Foam PE	0.285	(7.24)
Outer Conductor	SPC Strip Braid	0.295	(7.49)
Overall Braid	TC Braid over Al tape	0.330	(8.38)
Jacket	(see table above)	0.405	(10.29)

Mechanical Specifications

Performance Property	Units	US	(metric)
Bend Radius: installation	in. (mm)	1.00	(25.4)
Bend Radius: repeated	in. (mm)	4.0	(101.6)
Bending Moment	ft-lb (N-m)	0.5	(0.68)
Weight	lb/ft (kg/m)	0.080	(0.12)
Tensile Strength	lb (kg)	160	(72.6)
Flat Plate Crush	lb/in. (kg/mm)	40	(0.71)

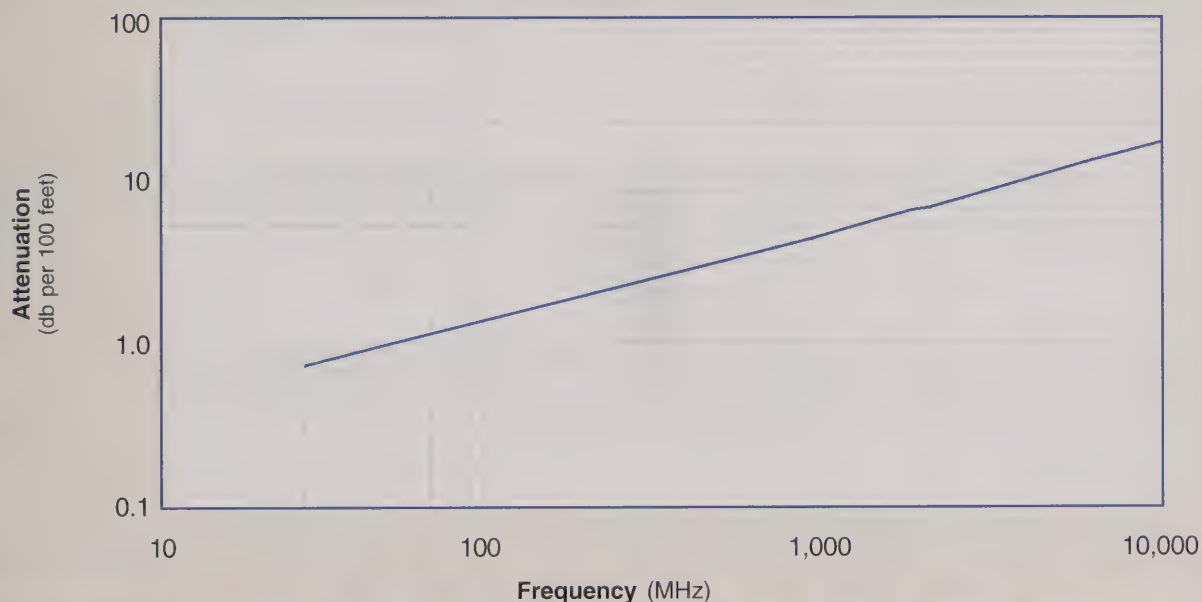
Environmental Specifications

Performance Property	°F	°C
Installation Temperature Range	-40/+185	-40/+85
Storage Temperature Range	-94/+185	-70/+185
Operating Temperature Range	-40/+185	-40/+85

Electrical Specifications

Performance Property	Units	US	(metric)
Cutoff Frequency	GHz		16.2
Velocity of Propagation	%		85
Dielectric Constant	NA		1.38
Time Delay	nS/ft (nS/m)	1.20	(3.92)
Impedance	ohms		50
Capacitance	pF/ft (pF/m)	23.9	(78.4)
Inductance	uH/ft (uH/m)	0.060	(0.20)
Shielding Effectiveness	dB		>100
DC Resistance			
Inner Conductor	ohms/1000ft (/km)	1.39	(4.6)
Outer Conductor	ohms/1000ft (/km)	1.17	(3.8)
Voltage Withstand	Volts DC		2500
Jacket Spark	Volts RMS		8000
Peak Power	kW		16
Passive Intermod	dBc		-155

Attenuation vs. Frequency (typical)



Frequency (MHz)	30	50	150	220	450	900	1500	1800	2000	2500	5800	10,000
Attenuation dB/100 ft	0.7	0.9	1.6	2.0	2.9	4.2	5.4	6.0	6.4	7.2	11.5	15.7
Attenuation dB/100 m	2.4	3.1	5.4	6.5	9.5	13.6	17.9	19.7	20.9	23.6	37.6	51.4
Avg. Power kW	3.12	2.41	1.38	1.13	0.78	0.54	0.41	0.37	0.35	0.31	0.19	0.14

Calculate Attenuation =

$(0.130555) \cdot \sqrt{\text{FMHz}} + (0.000262) \cdot \text{FMHz}$ (interactive calculator available at <http://www.timesmicrowave/telecom>)

Attenuation:

VSWR=1.0 ; Ambient = +25°C (77°F)

Power:

VSWR=1.0; Ambient = +40°C; Inner Conductor = 100°C (212°F); Sea Level; dry air; atmospheric pressure; no solar loading

TIMES MICROWAVE SYSTEMS

A Smiths Group plc company

TCOM-400

Low Loss Low Passive Intermod Coax



Connectors

Interface	Description	Part Number	Stock Code	VSWR** Freq. (GHz)	Coupling Nut	Inner Contact Attach	Outer Contact Attach	Finish* Body /Pin	Length in (mm)	Width in (mm)	Weight lb (g)
N Male	Straight Plug	SC-400-NM	3190-1454	<1.25:1 (2.5)	Knurl	Solder	Crimp	NG	1.5 (38)	0.75 (19.1)	0.090 (40.8)
	Straight Plug	TC-400-NM	3190-188	<1.25:1 (2.5)	Knurl	Solder	Crimp	NG	1.5 (38)	0.75 (19.1)	0.090 (40.8)
	Straight Plug	TC-400-NMC	3190-277	<1.25:1 (2.5)	Knurl	Solder	Clamp	NG	1.5 (38)	0.75 (19.1)	0.121 (54.9)
	Straight Plug	EZ-400-NMH	3190-400	<1.25:1 (10)	Hex	Spring Finger	Crimp	S/G	1.5 (38)	0.89 (22.6)	0.113 (51.3)
	Straight Plug	TC-400-NMH	3190-552	<1.25:1 (10)	Hex	Solder	Crimp	S/G	1.5 (38)	0.89 (22.6)	0.113 (51.3)
	Straight Plug	TC-400-NMK	3190-661	<1.25:1 (10)	Knurl	Spring Finger	Crimp	S/G	1.5 (38)	0.89 (22.6)	0.113 (51.3)
	Right Angle	TC-400-NMH-RA	3190-422	<1.35:1 (2.5)	Hex	Solder	Crimp	S/G	1.8 (46)	1.25 (31.8)	0.130 (59.0)
	Right Angle	TC-400-NMC-RA (A)	3190-870	<1.35:1 (2.5)	Hex	Solder	Clamp	AG	1.8 (46)	1.2 5 (31.8)	0.150 (68.0)
	Right Angle	EZ-400-NMH-RA	3190-761	<1.25:1 (6)	Hex	Spring Finger	Crimp	S/G	1.8 (46)	1.25 (31.8)	0.130 (59.0)
	Reverse Polarity	TC-400-NM-RP	3190-960	<1.25:1 (2.5)	Knurl	Solder	Crimp	NG	1.5 (38)	0.75 (19.1)	0.090 (40.8)
N Female	Straight Jack	TC-400-NFC	3190-299	<1.25:1 (2.5)	NA	Solder	Clamp	NS	1.6 (41)	0.75 (19.1)	0.119 (54.0)
	Straight Jack	EZ-400-NF	3190-956	<1.25:1 (2.5)	NA	Spring Finger	Crimp	NG	1.8 (45)	0.66 (16.8)	0.105 (47.6)
	Bulkhead Jack	EZ-400-NF-BH	3190-518	<1.25:1 (2.5)	NA	Spring Finger	Crimp	NG	1.8 (46)	0.88 (22.4)	0.102 (46.3)
	Bulkhead Jack	TC-400-NFC-BH (A)	3190-872	<1.25:1 (2.5)	NA	Solder	Clamp	AG	1.8 (46)	0.8 8 (22.4)	0.145 (65.8)
TNC Male	Straight Plug	TC-400-TM	3190-260	<1.25:1 (2.5)	Knurl	Solder	Crimp	NS	1.7 (43)	0.59 (15.0)	0.074 (33.6)
	Straight Plug	EZ-400-TM	3190-650	<1.25:1 (2.5)	Knurl	Spring Finger	Crimp	NS	1.7 (43)	0.59 (15.0)	0.074 (33.6)
	Right Angle	TC-400-TM-RA	3190-442	<1.35:1 (2.5)	Knurl	Solder	Crimp	NG	1.7 (43)	0.59 (15.0)	0.085 (38.6)
	Reverse Polarity	EZ-400-TM-RP	3190-794	<1.25:1 (2.5)	Knurl	Spring Finger	Crimp	AG	1.7 (43)	0.59 (15.0)	0.074 (33.6)
TNC Female	Reverse Polarity	EZ-400-TF-RP	3190-795	<1.25:1 (2.5)	NA	Spring Finger	Crimp	AG	1.8 (46)	0.55 (14.0)	0.074 (33.6)
SMA Male	Straight Plug	TC-400-SM	3190-439	<1.25:1 (6)	Hex	Solder	Crimp	NG	1.2 (29)	0.50 (12.7)	0.032 (14.5)
BNC Male	Straight Plug	TC-400-BM	3190-318	<1.25:1 (2.5)	Knurl	Solder	Crimp	NS	1.7 (43)	0.56 (14.2)	0.063 (28.6)
Mini-UHF	Straight Plug	TC-400-MUHF	3190-520	<1.25:1 (2.5)	Knurl	Solder	Crimp	NG	1.1 (28)	0.50 (12.7)	0.020 (9.1)
UHF Male	Straight Plug	EZ-400-UM	3190-997	<1.25:1 (2.5)	Knurl	Spring Finger	Crimp	NG	1.9 (48)	0.80 (20.3)	0.090 (40.8)
7-16 DIN Male	Straight Plug	TC-400-716-MC	3190-279	<1.25:1 (2.5)	Hex	Solder	Clamp	SS	1.4 (36)	1.40 (35.6)	0.268 (121.6)
7-16 DIN Female	Straight Jack	TC-400-716-FC	3190-376	<1.25:1 (2.5)	NA	Solder	Clamp	SS	1.6 (41)	1.13 (28.7)	0.281 (127.5)

* Finish metals: N=Nickel, S=Silver, G=Gold, SS=Stainless Steel, A=Alballoy **VSWR spec based on 3 foot cable with a connector pair



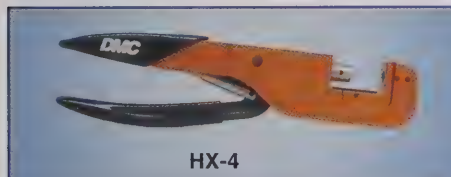
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Hardware Accessories



HG-400T

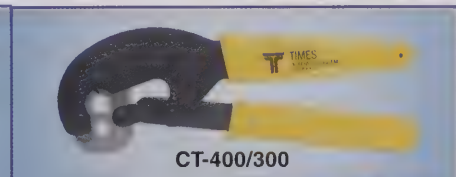
Type	Part Number	Stock Code	Description
Ground Kit	GK-S400T	GK-S400T	Standard Grounding Kit (each)
Hoisting Grip	HG-400T	HG-400T	Laced Type (each)



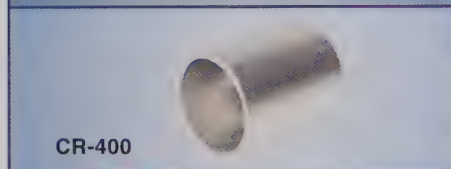
HX-4



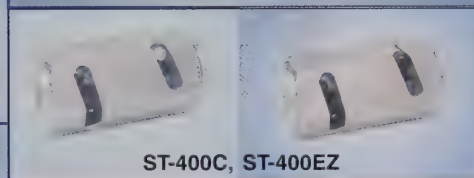
Y1719



CT-400/300



CR-400



ST-400C, ST-400EZ



DBT-01



CCT-01



TK-400EZ

Install Tools

Type	Part Number	Stock Code	Description
Crimp Tool	HX-4	3190-200	Crimp Handle
Crimp Dies	Y1719	3190-202	.429" Hex Dies
Crimp Tool	CT-400/300	3190-666	Crimp tool for LMR 400 connectors
Crimp Rings	CR-400	3190-830	Crimp rings for TC/EZ-400 connectors (package of 10)
Strip Tool	ST-400C	3190-228	For Clamp Connectors
Strip Tool	ST-400EZ	3190-401	For Crimp Connectors
Deburr Tool	DBT-01	3190-406	Removes center conductor rough edges
Cutting Tool	CCT-01	3190-1544	Cable end flush cut tool
Replacement Blades	RB-01	3190-1609	Replacement blades for cutting tool
Tool Kit	TK-400EZ	3190-1602	Tool kit for LMR-400 Crimp Connectors (includes CCT-01, ST-400EZ, CT-400/300, DBT-01, Tool Pouch)

TIMES MICROWAVE SYSTEMS

A Smiths Group plc company

TCOM-500

Low Loss Low Passive Intermod Coax

Ideal for...

- -155 dBc Intermodulation Distortion
- Low Loss UHF/Microwave Interconnect
- Wireless Base Station Interconnect
- Flexible for Easy Routing



• **TCOM®** standard is a UV Resistant Polyethylene jacketed cable designed for 20-year service outdoor use. The bending and handling characteristics are significantly better than air-dielectric and corrugated hard-line cables.

TCOM®-FR is a non-halogen (non-toxic), low smoke, fire retardant cable designed for in-building runs that can be routed anywhere except air handling plenums. TCOM-FR has a UL/NEC & CSA rating of 'CMR/MPR' and 'FT4' respectively.

TCOM®-PUR has a polyurethane outer jacket designed for multiple bending/flexing cycles in rugged tactical applications.

Flexibility and bendability are hallmarks of the TCOM-500 cable design. The flexible outer conductor enables the tightest bend radius available for any cable of similar size and performance.

Low Loss is another hallmark feature of TCOM-500. Size for size LMR has the lowest loss of any flexible cable and comparable loss to semirigid hard-line cables.

Passive Intermod is lower than -155 dBc exceed the performance levels for most wireless applications.

RF Shielding is 60 dB greater than typical single shielded coax (40 dB). The multi-ply bonded foil outer conductor is rated conservatively at > 100 dB (i.e. >200 dB between two adjacent cables).

Weatherability: TCOM-500 cables designed for outdoor exposure incorporate the best materials for UV resistance and have life expectancy in excess of 20 years.

Connectors: A wide variety of connectors are available for TCOM-500 cable, including all common interface types, reverse polarity, and a choice of solder or non-solder center pins. Most LMR connectors employ crimp outer attachment using standard hex crimp sizes.

Cable Assemblies: All TCOM-500 cable types are available as pre-terminated cable assemblies. Refer to the section on Flex Tech for further details.

Part Description					Stock
Part No.	Application	Jacket	Color		Code
TCOM-500	Outdoor	PE	Black		55004
TCOM-500-FR	Indoor-Riser	CMR	FRPE	Black	55024

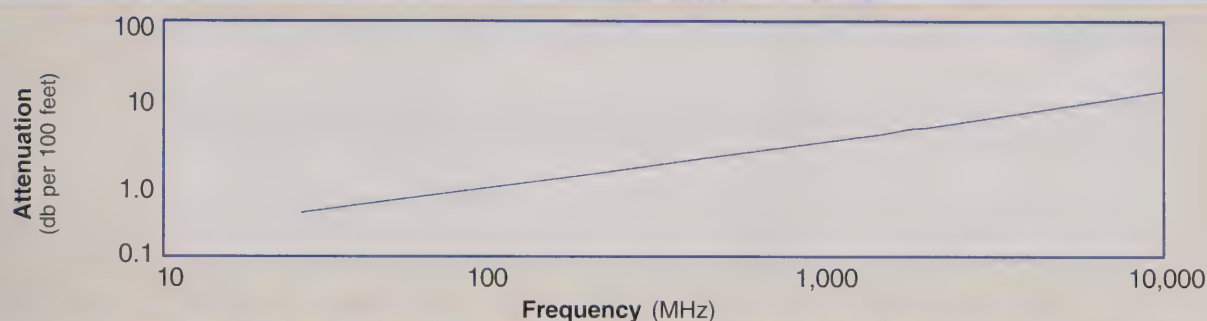
Construction Specifications			
Description	Material	In.	(mm)
Inner Conductor	Solid BCCAl	0.142	(3.61)
Dielectric	Foam PE	0.370	(9.40)
Outer Conductor	SPC Strip Braid	0.380	(9.65)
Overall Braid	TC Braid over Al tape	0.415	(10.54)
Jacket	(see table above)	0.500	(12.70)

Mechanical Specifications			
Performance Property	Units	US	(metric)
Bend Radius: installation	in. (mm)	1.25	(31.8)
Bend Radius: repeated	in. (mm)	5.0	(127.0)
Bending Moment	ft-lb (N-m)	1.75	(2.37)
Weight	lb/ft (kg/m)	0.097	(0.14)
Tensile Strength	lb (kg)	260	(118.0)
Flat Plate Crush	lb/in. (kg/mm)	50	(0.89)

Environmental Specifications			
Performance Property		°F	°C
Installation Temperature Range		-40/+185	-40/+85
Storage Temperature Range		-94/+185	-70/+185
Operating Temperature Range		-40/+185	-40/+85

Electrical Specifications			
Performance Property	Units	US	(metric)
Cutoff Frequency	GHz	12.6	
Velocity of Propagation	%	86	
Dielectric Constant	NA	1.35	
Time Delay	nS/ft (nS/m)	1.18	(3.88)
Impedance	ohms	50	
Capacitance	pF/ft (pF/m)	23.6	(77.5)
Inductance	uH/ft (uH/m)	0.059	(0.19)
Shielding Effectiveness	dB	>100	
DC Resistance			
Inner Conductor	ohms/1000ft (/km)	0.82	(2.7)
Outer Conductor	ohms/1000ft (/km)	0.907	(3.0)
Voltage Withstand	Volts DC	3000	
Jacket Spark	Volts RMS	8000	
Peak Power	kW	22	
Passive Intermod	dBc	-155	

Attenuation vs. Frequency (typical)



Frequency (MHz)	30	50	150	220	450	900	1500	1800	2000	2500	5800	10,000
Attenuation dB/100 ft	0.6	0.7	1.3	1.6	2.3	3.3	4.3	4.8	5.0	5.7	9.2	12.7
Attenuation dB/100 m	1.8	2.4	4.2	5.1	7.4	10.7	14.1	15.6	16.5	18.7	30.2	41.7
Avg. Power kW	4.21	3.25	1.85	1.52	1.04	0.72	0.55	0.49	0.47	0.41	0.25	0.18

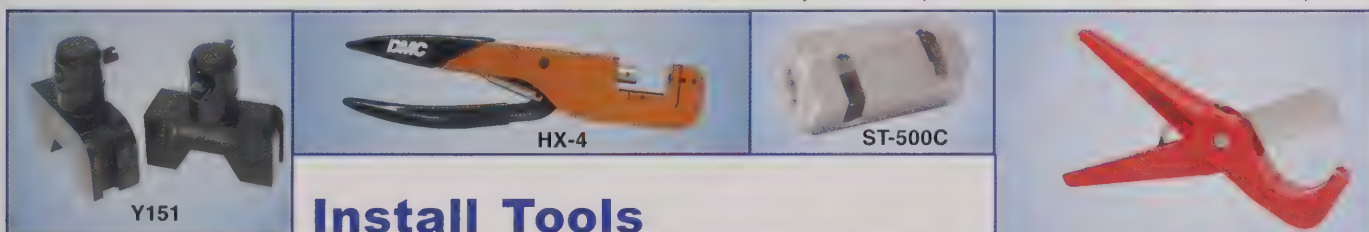
Calculate Attenuation = $(0.100972) \cdot \sqrt{\text{FMHz}} + (0.000262) \cdot \text{FMHz}$ (interactive calculator available at <http://www.timesmicrowave/telecom>)
 Attenuation: VSWR=1.0; Ambient = +25°C (77°F) Power: VSWR=1.0; Ambient = +40°C; Inner Conductor = 100°C (212°F);
 Sea Level; dry air; atmospheric pressure; no solar loading



Connectors

Interface	Description	Part Number	Stock Code	VSWR** Freq. (GHz)	Coupling Nut	Inner Contact Attach	Outer Contact Attach	Finish* Body /Pin	Length in (mm)	Width in (mm)	Weight lb (g)
N Male	Straight Plug	TC-500-NMC	3190-377	<1.25:1 (2.5)	Hex	Solder	Clamp	S/G	2.1 (53)	0.92 (23.4)	0.228 (103.4)
	Right Angle	TC-500-NMC-RA	3190-227	<1.35:1 (2.5)	Hex	Solder	Clamp	S/G	2.4 (61)	1.5 (38.1)	0.275 (124.7)
N Female	Straight Jack	TC-500-NFC	3190-215	<1.25:1 (2.5)	NA	Solder	Clamp	S/G	2.2 (56)	0.94 (23.9)	0.215 (97.5)
	Bulkhead Kit	BHA-KIT	3190-223	<1.25:1 (2.5)	NA	NA	NA	NA	NA	NA	0.014 (6.4)
TNC Male	Straight Plug	TC-500-TM	3190-464	<1.25:1 (2.5)	Hex	Solder	Crimp	N/G	1.5 (38)	0.62 (15.7)	0.082 (28.1)
UHF Male	Straight Plug	TC-500-UMC	3190-354	<1.25:1 (2.5)	Knurl	Solder	Clamp	S/G	2.1 (53)	0.88 (22.4)	0.215 (97.5)

* Finish metals: N=Nickel, S=Silver, G=Gold, SS=Stainless Steel, A=Alloy **VSWR spec based on 3 foot cable with a connector pair



Install Tools

Type	Part Number	Stock Code	Description
Crimp Tool	HX-4	3190-200	Crimp Handle
Crimp Dies	Y151	3190-465	.532" Hex Dies
Strip Tool	ST-500C	3190-229	For Clamp Style Connectors
Deburr Tool	DBT-01	3190-406	Removes center conductor rough edges
Cutting Tool	CCT-01	3190-1544	Cable end flush cut tool
Replacement Blades	RB-01	3190-1609	Replacement blades for cutting tool

TIMES MICROWAVE SYSTEMS

A Smiths Group plc company

TCOM-600

Low Loss Low Passive Intermod Coax

Ideal for...

- -155 dBc Intermodulation Distortion
- Low Loss UHF/Microwave Interconnect
- Wireless Base Station Interconnect
- Flexible for Easy Routing



• **TCOM®** standard is a UV Resistant Polyethylene jacketed cable designed for 20-year service outdoor use. The bending and handling characteristics are significantly better than air-dielectric and corrugated hard-line cables.

TCOM®-FR is a non-halogen (non-toxic), low smoke, fire retardant cable designed for in-building runs that can be routed anywhere except air handling plenums. TCOM-FR has a UL/NEC & CSA rating of 'CMR/MPR' and 'FT4' respectively.

TCOM®-PUR has a polyurethane outer jacket designed for multiple bending/flexing cycles in rugged tactical applications.

Flexibility and bendability are hallmarks of the TCOM-600 cable design. The flexible outer conductor enables the tightest bend radius available for any cable of similar size and performance.

Low Loss is another hallmark feature of TCOM-600. Size for size LMR has the lowest loss of any flexible cable and comparable loss to semirigid hard-line cables.

Passive Intermod is lower than -155 dBc exceed the performance levels for most wireless applications..

RF Shielding is 60 dB greater than typical single shielded coax (40 dB). The multi-ply bonded foil outer conductor is rated conservatively at > 100 dB (i.e. >200 dB between two adjacent cables).

Weatherability: TCOM-600 cables designed for outdoor exposure incorporate the best materials for UV resistance and have life expectancy in excess of 20 years.

Connectors: A wide variety of connectors are available for TCOM-600 cable, including all common interface types, reverse polarity, and a choice of solder or non-solder center pins. Most LMR connectors employ crimp outer attachment using standard hex crimp sizes.

Cable Assemblies: All TCOM-600 cable types are available as pre-terminated cable assemblies. Refer to the section on FlexTech for further details.

Part Description					Stock
Part No.	Application	Jacket	Color	Code	
TCOM-600	Outdoor	PE	Black	55005	
TCOM-600-FR	Indoor-Riser	CMR	FRPE	Black	55018
TCOM-600-PUR	Indoor/Outdoor	PUR	Black	55006	

Construction Specifications			
Description	Material	In.	(mm)
Inner Conductor	Solid BCCAl	0.176	(4.47)
Dielectric	Foam PE	0.455	(11.56)
Outer Conductor	SPC Strip Braid	0.465	(11.81)
Overall Braid	TC Braid over Al tape	0.500	(12.70)
Jacket	(see table above)	0.590	(14.99)

Mechanical Specifications

Performance Property	Units	US	(metric)
Bend Radius: installation	in. (mm)	1.50	(38.1)
Bend Radius: repeated	in. (mm)	6.0	(152.4)
Bending Moment	ft-lb (N-m)	2.75	(3.73)
Weight	lb/ft (kg/m)	0.160	(0.24)
Tensile Strength	lb (kg)	350	(158.9)
Flat Plate Crush	lb/in. (kg/mm)	60	(1.07)

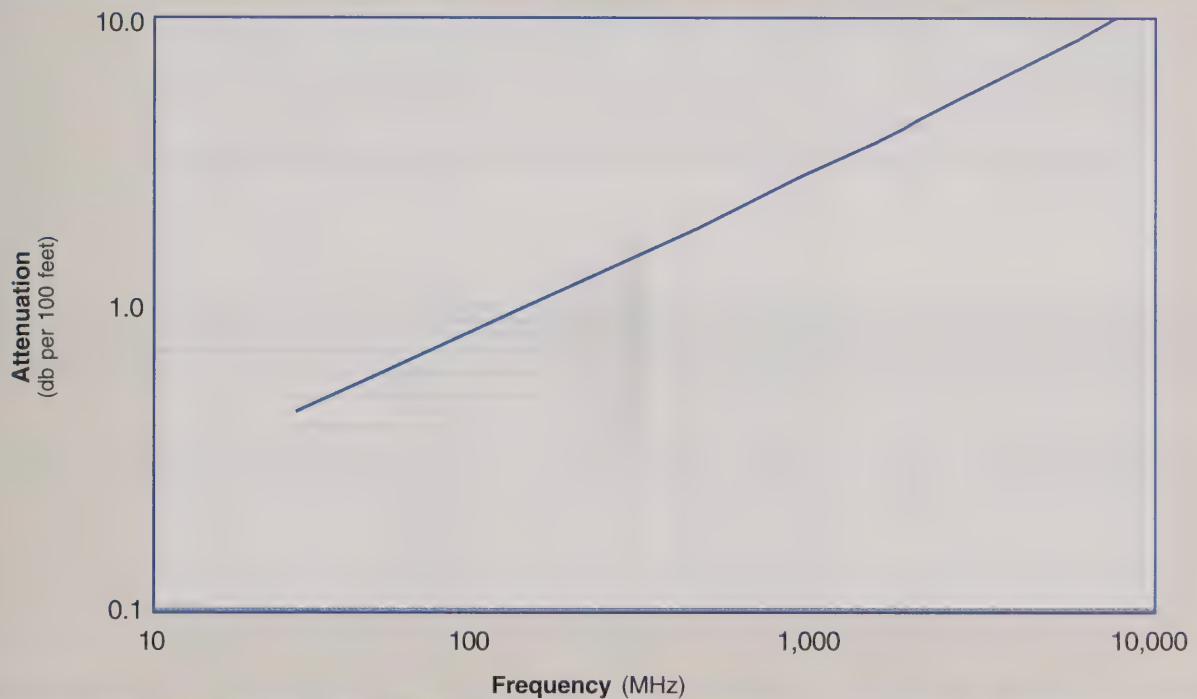
Environmental Specifications

Performance Property	°F	°C
Installation Temperature Range	-40/+185	-40/+85
Storage Temperature Range	-94/+185	-70/+85
Operating Temperature Range	-40/+185	-40/+85

Electrical Specifications

Performance Property	Units	US	(metric)
Cutoff Frequency	GHz		10.3
Velocity of Propagation	%		87
Dielectric Constant	NA		1.32
Time Delay	nS/ft (nS/m)	1.17	(3.83)
Impedance	ohms		50
Capacitance	pF/ft (pF/m)	23.4	(76.6)
Inductance	uH/ft (uH/m)	0.058	(0.19)
Shielding Effectiveness	dB		>100
DC Resistance			
Inner Conductor	ohms/1000ft (/km)	1.53	(1.7)
Outer Conductor	ohms/1000ft (/km)	0.785	(2.6)
Voltage Withstand	Volts DC		4000
Jacket Spark	Volts RMS		8000
Peak Power	kW		40
Passive Intermod	dBc		-155

Attenuation vs. Frequency (typical)



Frequency (MHz)	30	50	150	220	450	900	1500	1800	2000	2500	5800	10,000
Attenuation dB/100 ft	0.4	0.6	1.0	1.2	1.8	2.6	3.5	3.9	4.1	4.6	7.6	10.6
Attenuation dB/100 m	1.5	1.9	3.3	4.1	6.0	8.6	11.4	12.7	13.4	15.2	24.9	34.7
Avg. Power kW	5.20	4.01	2.28	1.86	1.28	0.88	0.66	0.60	0.56	0.50	0.30	0.22

Calculate Attenuation =

$(0.080075) \cdot \sqrt{\text{FMHz}} + (0.000256) \cdot \text{FMHz}$ (interactive calculator available at <http://www.timesmicrowave/telecom>)

Attenuation:

VSWR=1.0 ; Ambient = +25°C (77°F)

Power:

VSWR=1.0; Ambient = +40°C; Inner Conductor = 100°C (212°F); Sea Level; dry air; atmospheric pressure; no solar loading

TIMES MICROWAVE SYSTEMS

A Smiths Group plc company

TCOM-600

Low Loss Low Passive Intermod Coax



600 Connectors

Interface	Description	Part Number	Stock Code	VSWR** Freq. (GHz)	Coupling Nut	Inner Contact Attach	Outer Contact Attach	Finish* Body /Pin	Length in (mm)	Width in (mm)	Weight lb (g)
N Male	Straight Plug	EZ-600-NMH-B	3190-271	<1.25:1 (2.5)	Hex	Spring Finger	Crimp	S/G	2.1 (53)	0.92 (23.4)	1.164 (74.4)
	Straight Plug	EZ-600-NMC	3190-355	<1.25:1 (2.5)	Hex	Spring Finger	Clamp	SG	2.1 (53)	0.92 (23.4)	0.202 (91.6)
	Straight Plug	TC-600-NMC	3190-357	<1.25:1 (2.5)	Hex	Solder	Clamp	SG	2.1 (53)	0.92 (23.4)	0.208 (93.4)
	Right Angle	TC-600-NMC-RA	3190-233	<1.35:1 (2.5)	Hex	Solder	Clamp	SG	2.1 (53)	0.92 (23.4)	0.280 (17.9)
	Right Angle	TC-600-NMH-RA	3190-785	<1.35:1 (6)	Hex	Solder	Crimp	SG	2.1 (53)	0.92 (23.4)	0.185 (83.9)
N Female	Bulkhead Jack	EZ-600-NF-BH	3190-616	<1.25:1 (2.5)	NA	Spring Finger	Crimp	SG	2.4 (61)	0.88 (22.4)	0.195 (88.5)
	Bulkhead Jack	TC-600-NF-BH	3190-589	<1.25:1 (2.5)	NA	Solder	Crimp	SG	2.4 (61)	0.88 (22.4)	0.195 (88.5)
	Bulkhead Jack	TC-600-NFC-BH	3190-466	<1.25:1 (2.5)	NA	Solder	Clamp	SG	2.2 (56)	0.94 (23.9)	0.214 (97.1)
TNC Male	Straight Plug	EZ-600-TM	3190-418	<1.25:1 (2.5)	Knurl	Spring Finger	Crimp	SG	1.7 (43)	0.59 (15.0)	0.112 (50.8)
UHF Male	Straight Plug	EZ-600-UM	3190-615	<1.25:1 (2.5)	Knurl	Spring Finger	Crimp	SG	1.7 (43)	0.88 (22.4)	0.164 (74.4)
	Straight Plug	TC-600-UMC	3190-213	<1.25:1 (2.5)	Knurl	Solder	Clamp	SG	1.7 (43)	0.88 (22.4)	0.198 (89.8)
7-16 DIN Male	Straight Plug	EZ-600-716-MH	3190-503	<1.25:1 (2.5)	Hex	Spring Finger	Crimp	SS	2.0 (51)	1.30 (33.0)	0.254 (115.2)
	Straight Plug	TC-600-716-MC	3190-502	<1.25:1 (2.5)	Hex	Solder	Clamp	SS	2.0 (51)	1.30 (33.0)	0.347 (157.4)
	Right Angle	TC-600-716M-RA	3190-395	<1.35:1 (2.5)	Hex	Solder	Crimp	SS	1.4 (36)	1.40 (35.6)	0.354 (160.8)
7-16 DIN Female	Straight Jack	TC-600-716-FC	3190-375	<1.25:1 (2.5)	NA	Solder	Clamp	SS	1.1 (28)	1.00 (25.4)	0.249 (112.9)
7/8 EIA	Flange	TC-600-78EIA	3190-321	<1.25:1 (2.5)	NA	Solder	Clamp	SS	2.3 (58)	2.60 (66.0)	0.873 (396.0)

* Finish metals: N=Nickel, S=Silver, G=Gold, SS=Stainless Steel, A=Alballoy **VSWR spec based on 3 foot cable with a connector pair



Accessories

Type	Part Number	Stock Code	Description
Crimp Tool	HX-4	3190-200	Crimp Handle
Crimp Dies	Y1720	3190-203	Standard .610" Hex
Strip Tool	ST-600C	3190-230	For Clamp Style Connectors
Strip Tool	ST-600EZ	3190-310	For Crimp Style Connectors
Deburr Tool	DBT-01	3190-406	Removes center conductor rough edges
Ground Kit	GK-S600T	GK-S600T	Standard Grounding Kit (each)
Hoisting Grip	HG-600T	HG-600T	Split/Laced Type (each)
Cold Shrink	CS-A600T	CS-A600T	Cable to Antenna Junction (each)
Cold Shrink	CS-60120T	CS-60120T	LMR-600 to -1200 Junction (each)
Cold Shrink	CS-60170T	CS-60170T	LMR-600 to -1700 Junction (each)
Standard Entry Port Cushion	SC-600T	SC-600T	Three Cables (each)
Standard Entry Panels			Full Range of Port Styles/Combinations Available
Hanger Blocks	CB-600T	CB-600T	Dual Cable Support Block (kit of 10)
Hanger Block Supporting Hardware			Complete Range of Supporting Hardware & Adapters Available

TIMES MICROWAVE SYSTEMS

A Smiths Group plc company

FBT-195

Flexible Low Loss High Power Communications Coax

Ideal for...

- High Power Base Station Jumper Assemblies
- In-Building Plenum Feeder Runs
- Any High Power Low Loss RF cable application



• **FBT**® is an indoor/outdoor highly fire retarded cable intended specifically for runs within and between base station cabinets. It is also applicable for return air handling plenums (e.g., dropped ceilings, raised floors). It has a UL/NEC & CSA rating of 'CMP/MPP' and 'FT6' respectively.

• **Flexibility** and bendability are hallmarks of the FBT-195 cable design. The flexible outer conductor enables the tightest bend radius available for any cable of similar size and performance.

• **Low Loss** is another hallmark feature of FBT-195. Size for size LMR has the lowest loss of any flexible cable and comparable loss to semirigid hard-line cables.

• **RF Shielding** is 50 dB greater than typical single shielded coax (40 dB). The multi-ply bonded foil outer conductor is rated conservatively at > 90 dB (i.e. >180 dB between two adjacent cables).

• **Weatherability:** FBT-195 cables designed for outdoor exposure incorporate Teflon® FEP jackets for UV resistance and have life expectancy in excess of 20 years.

• **Connectors:** A wide variety of connectors are available for FBT-195 cable, including all common interface types, reverse polarity, and a choice of solder or non-solder center pins. Most LMR connectors employ crimp outer attachment using standard hex crimp sizes.

• **Cable Assemblies** – All FBT-195 cable types are available as pre-terminated cable assemblies. Refer to the section on FlexTech for further details.

Construction Specifications			
Description	Material	In.	(mm)
Inner Conductor	Solid BC	0.037	(0.94)
Dielectric	Low Density PTFE	0.113	(2.87)
Outer Conductor	Aluminum Tape	0.119	(3.02)
Overall Braid	Tinned Copper	0.142	(3.61)
Jacket	Brown FEP	0.175	(4.45)

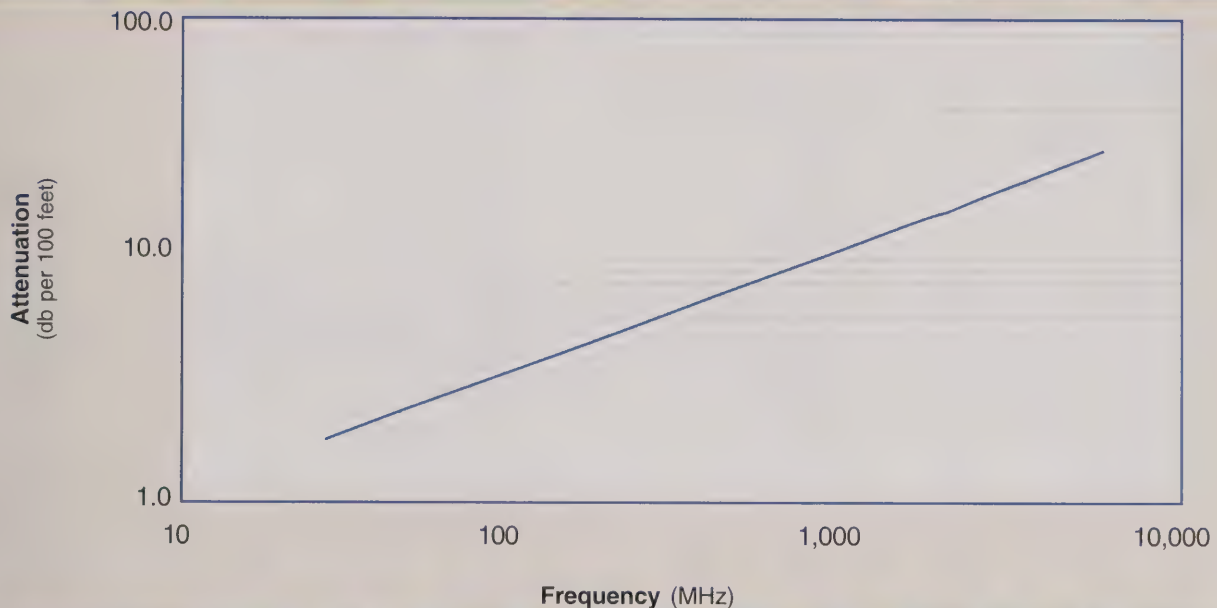
Mechanical Specifications			
Performance Property	Units	US	(metric)
Bend Radius: installation	in. (mm)	0.5	(12.7)
Bend Radius: repeated	in. (mm)	2	(50.8)
Bending Moment	ft-lb (N-m)	0.1	(0.14)
Weight	lb/ft (kg/m)	0.020	(0.03)
Tensile Strength	lb (kg)	40	(18.2)
Flat Plate Crush	lb/in. (kg/mm)	10	(0.19)

Environmental Specifications			
Performance Property	°F	°C	
Installation Temperature Range	-67/+302	-55/+150	
Storage Temperature Range	-67/+302	-55/+150	
Operating Temperature Range	-67/+302	-55/+150	

Electrical Specifications			
Performance Property	Units	US	(metric)
Cutoff Frequency	GHz	36	
Velocity of Propagation	%	76	
Dielectric Constant	NA	1.73	
Time Delay	nS/ft (nS/m)	1.34	(4.40)
Impedance	ohms	50	
Capacitance	pF/ft (pF/m)	26.7	(87.6)
Inductance	uH/ft (uH/m)	0.067	(0.22)
Shielding Effectiveness	dB	>90	
DC Resistance			
Inner Conductor	ohms/1000ft (/km)	9.50	(31.2)
Outer Conductor	ohms/1000ft (/km)	4.90	(16.1)
Voltage Withstand	Volts DC	1000	
Jacket Spark	Volts RMS	3000	
Peak Power	kW	2.5	

Part Description				
Part No.	Application	Jacket	Color	Stock Code
FBT-195	Indoor/Outdoor	FEP	Brown	54165

Attenuation vs. Frequency (typical)



Frequency (MHz)	30	50	150	220	450	900	1500	1800	2000	2500	3400	5800
Attenuation dB/100 ft	1.9	2.4	4.2	5.1	7.3	10.4	13.5	14.8	15.6	17.5	20.5	27.0
Attenuation dB/100 m	6.1	7.9	13.8	16.7	24.0	34.1	44.2	48.5	51.2	57.4	67.2	88.6
Avg. Power kW	1.62	1.25	0.72	0.59	0.41	0.29	0.22	0.20	0.19	0.17	0.14	0.11

Calculate Attenuation = $(0.340820) \cdot \sqrt{\text{FMHz}} + (0.000183) \cdot \text{FMHz}$ (interactive calculator available at <http://www.timesmicrowave/telecom>)
 Attenuation: VSWR=1.0 ; Ambient = +25°C (77°F) Power: VSWR=1.0; Ambient = +40°C; Inner Conductor = 100°C (212°F);
 Sea Level; dry air; atmospheric pressure; no solar loading



TC-195-NM



TC-195-SM

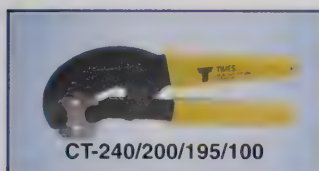


TC-195-TM

Connectors

Interface	Description	Part Number	Stock Code	VSWR** Freq. (GHz)	Coupling Nut	Inner Contact Attach	Outer Contact Attach	Finish* Body /Pin	Length in (mm)	Width in (mm)	Weight lb (g)
N male	Straight Plug	TC-195-NM	3190-224	<1.25:1 (2.5)	Knurl	Solder	Crimp	SG	1.5 (38.1)	0.75 (19.1)	0.073 (33.1)
SMA male	Straight Plug	TC-195-SM	3190-1551	<1.25:1 (2.5)	Hex	Solder	Crimp	SS/G	1.0 (25.4)	0.32 (8.1)	0.015 (6.8)
TNC male	Straight Plug	TC-195-TM	3190-1552	<1.25:1 (2.5)	Knurl	Solder	Crimp	SG	1.4 (35.6)	0.59 (15.0)	0.045 (20.4)

* Finish metals: N=Nickel, S=Silver, G=Gold, SS=Stainless Steel, A=Alballoy **VSWR spec based on 3 foot cable with a connector pair



CT-240/200/195/100

Install Tools

Type	Part Number	Stock Code	Description
Crimp Tool	CT-240/200/195/100	3190-667	Crimp tool for LMR-195 connectors
Cutting Tool	CCT-01	3190-1544	Cable and flush cut tool
Replacement Blades	RB-01	3190-1609	Replacement blades for cutting tool



CCT-01

TIMES MICROWAVE SYSTEMS

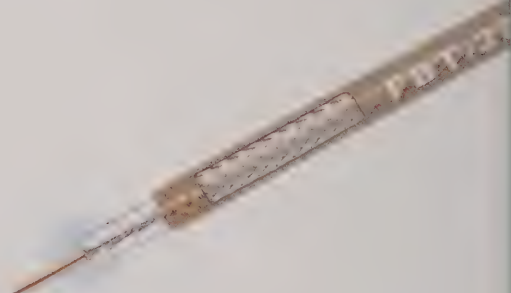
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FBT-200

Flexible Low Loss High Power Communications Coax

Ideal for...

- High Power Base Station Jumper Assemblies
- In-Building Plenum Feeder Runs
- Any High Power Low Loss RF cable application



• **FBT** is an indoor/outdoor highly fire retarded cable intended specifically for runs within and between base station cabinets. It is also applicable for return air handling plenums (e.g., dropped ceilings, raised floors). It has a UL/NEC & CSA rating of 'CMP/MPP' and 'FT6' respectively.

• **Flexibility** and bendability are hallmarks of the FBT-200 cable design. The flexible outer conductor enables the tightest bend radius available for any cable of similar size and performance.

• **Low Loss** is another hallmark feature of FBT-200. Size for size FBT has the lowest loss of any flexible cable and comparable loss to semirigid hard-line cables.

• **RF Shielding** is 50 dB greater than typical single shielded coax (40 dB). The multi-ply bonded foil outer conductor is rated conservatively at > 90 dB (i.e. >180 dB between two adjacent cables).

• **Weatherability:** FBT-200 cables designed for outdoor exposure incorporate Teflon® FEP jackets for UV resistance and have life expectancy in excess of 20 years.

• **Connectors:** A wide variety of connectors are available for FBT-200 cable, including all common interface types, reverse polarity, and a choice of solder or non-solder center pins. Most FBT connectors employ crimp outer attachment using standard hex crimp sizes.

• **Cable Assemblies** – All FBT-200 cable types are available as pre-terminated cable assemblies. Refer to the section on FlexTech for further details.

Construction Specifications			
Description	Material	In.	(mm)
Inner Conductor	Solid BC	0.040	(1.02)
Dielectric	Low Density PTFE	0.118	(3.00)
Outer Conductor	Aluminum Tape	0.123	(3.12)
Overall Braid	Tinned Copper	0.146	(3.71)
Jacket	Brown FEP	0.175	(4.45)

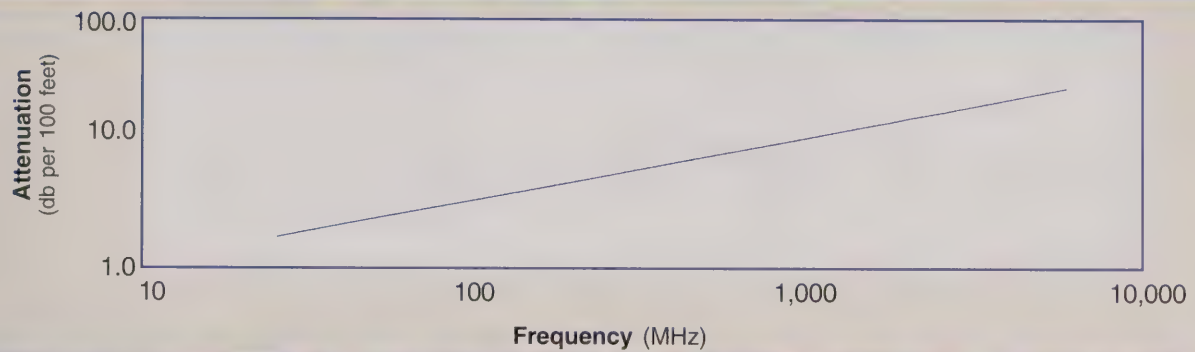
Mechanical Specifications			
Performance Property	Units	US	(metric)
Bend Radius: installation	in. (mm)	0.5	(12.7)
Bend Radius: repeated	in. (mm)	2	(50.8)
Bending Moment	ft-lb (N-m)	0.2	(0.27)
Weight	lb/ft (kg/m)	0.032	(0.05)
Tensile Strength	lb (kg)	30	(13.6)
Flat Plate Crush	lb/in. (kg/mm)	65	(1.169)

Environmental Specifications			
Performance Property	°F	°C	
Installation Temperature Range	-67/+302	-55/+150	
Storage Temperature Range	-67/+302	-55/+150	
Operating Temperature Range	-67/+302	-55/+150	

Electrical Specifications			
Performance Property	Units	US	(metric)
Cutoff Frequency	GHz	36	
Velocity of Propagation	%	76	
Dielectric Constant	NA	1.73	
Time Delay	nS/ft (nS/m)	1.34	(4.40)
Impedance	ohms	50	
Capacitance	pF/ft (pF/m)	26.7	(87.6)
Inductance	uH/ft (uH/m)	0.067	(0.22)
Shielding Effectiveness	dB	>90	
DC Resistance			
Inner Conductor	ohms/1000ft (/km)	6.50	(21.3)
Outer Conductor	ohms/1000ft (/km)	4.90	(16.1)
Voltage Withstand	Volts DC	1000	
Jacket Spark	Volts RMS	3000	
Peak Power	kW	2.5	

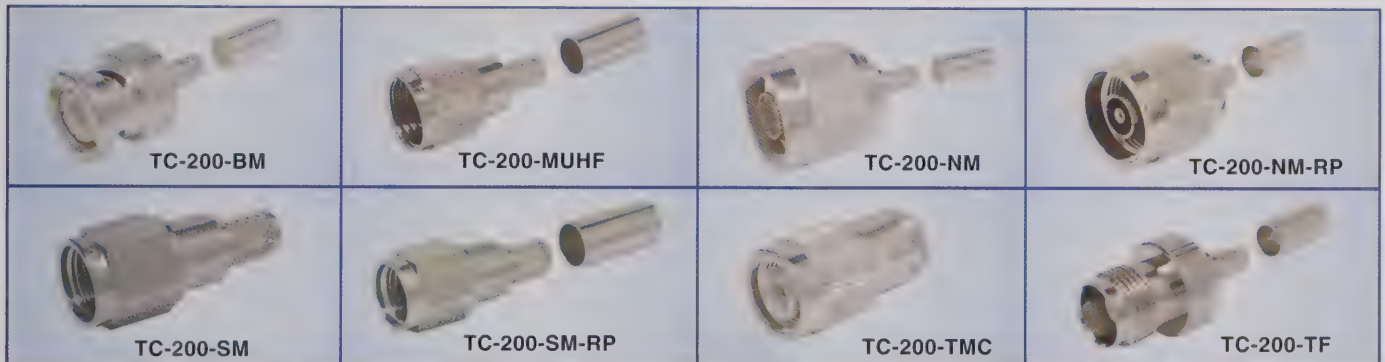
Part Description				
Part No.	Application	Jacket	Color	Stock Code
FBT-200	Indoor/Outdoor	FEP	Brown	54166

Attenuation vs. Frequency (typical)



Frequency (MHz)	30	50	150	220	450	900	1500	1800	2000	2500	3400	5800
Attenuation dB/100 ft	1.8	2.3	4.1	4.9	7.1	10.0	13.0	14.3	15.1	16.9	19.8	26.1
Attenuation dB/100 m	5.9	7.7	13.3	16.1	23.2	32.9	42.7	46.9	49.5	55.5	65.0	85.7
Avg. Power kW	1.71	1.32	0.76	0.62	0.43	0.30	0.23	0.21	0.20	0.18	0.15	0.11

Calculate Attenuation = $(0.329075) \cdot \sqrt{\text{FMHz}} + (0.000183) \cdot \text{FMHz}$ (interactive calculator available at <http://www.timesmicrowave/telecom>)
 Attenuation: VSWR=1.0; Ambient = +25°C (77°F) Power: VSWR=1.0; Ambient = +40°C; Inner Conductor = 100°C (212°F);
 Sea Level; dry air; atmospheric pressure; no solar loading



Connectors

Interface	Description	Part Number	Stock Code	VSWR** Freq. (GHz)	Coupling Nut	Inner Contact Attach	Outer Contact Attach	Finish* Body /Pin	Length in (mm)	Width in (mm)	Weight lb (g)
N Male	Straight Plug	TC-200-NM	3190-224	<1.25:1 (2.5)	Knurl	Solder	Crimp	S/G	1.5 (38.1)	0.75 (19.1)	0.073 (33.1)
	Reverse Polarity	TC-200-NM-RP	3190-959	<1.25:1 (2.5)	Knurl	Solder	Crimp	N/G	1.5 (38.0)	0.75 (19.1)	0.073 (33.1)
BNC Male	Straight Plug	TC-200-BM	3190-225	<1.25:1 (2.5)	Knurl	Solder	Crimp	S/G	1.7 (43.2)	0.56 (14.2)	0.045 (20.4)
TNC Male	Straight Plug	TC-200-TMC	3190-240	<1.25:1 (2.5)	Knurl	Solder	Clamp	S/G	1.7 (43.2)	0.59 (15.0)	0.045 (20.4)
TNC Female	Straight Jack	TC-200-TF	3190-263	<1.25:1 (2.5)	NA	Solder	Crimp	N/G	1.3 (33.0)	0.57 (14.5)	0.033 (15.0)
SMA -Male	Straight plug	TC-200-SM	3190-612	<1.25:1 (8)	Hex	Solder	Crimp	SS/G	1.0 (25.4)	0.32 (8.1)	0.015 (6.8)
SMA-Rev. Polarity	Straight Plug	TC-200-SM-RP	3190-327	<1.25:1 (2.5)	Hex	Solder	Crimp	SS/G	1.0 (25.4)	0.32 (8.1)	0.015 (6.8)
Mini-UHF	Straight Plug	TC-200-MUHF	3190-444	<1.25:1 (2.5)	Knurl	Solder	Crimp	NG	1.1 (27.9)	0.45 (11.4)	0.015 (6.8)

* Finish metals: N=Nickel, S=Silver, G=Gold, SS=Stainless Steel, A=Alballoy **VSWR spec based on 3 foot cable with a connector pair

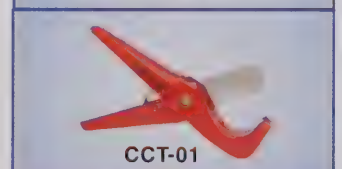
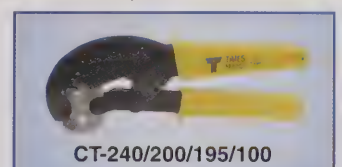
Hardware Accessories

Type	Part Number	Stock Code	Description
Ground Kit	GK-S200T	GK-S200T	Standard Ground Kit (each)



Install Tools

Type	Part Number	Stock Code	Description
Crimp Tool	CT-240/200/195/100	3190-667	Crimp tool for LMR 200 connectors
Cutting Tool	CCT-01	3190-1544	Cable and flush cut tool
Replacement Blades	RB-01	3190-1609	Replacement blades for cutting tool



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FBT-240

Flexible Low Loss High Power Communications Coax

Ideal for...

- High Power Base Station Jumper Assemblies
- In-Building Plenum Feeder Runs
- Any High Power Low Loss RF cable application



• **FBT®** is an indoor/outdoor highly fire retarded cable intended specifically for runs within and between base station cabinets. It is also applicable for return air handling plenums (e.g., dropped ceilings, raised floors). It has a UL/NEC & CSA rating of 'CMP/MPP' and 'FT6' respectively.

• **Flexibility** and bendability are hallmarks of the FBT-240 cable design. The flexible outer conductor enables the tightest bend radius available for any cable of similar size and performance.

• **Low Loss** is another hallmark feature of FBT-240. Size for size LMR has the lowest loss of any flexible cable and comparable loss to semirigid hard-line cables.

• **RF Shielding** is 50 dB greater than typical single shielded coax (40 dB). The multi-ply bonded foil outer conductor is rated conservatively at > 90 dB (i.e. >180 dB between two adjacent cables).

• **Weatherability:** FBT-240 cables designed for outdoor exposure incorporate Teflon® FEP jackets for UV resistance and have life expectancy in excess of 20 years.

• **Connectors:** A wide variety of connectors are available for FBT-240 cable, including all common interface types, reverse polarity, and a choice of solder or non-solder center pins. Most LMR connectors employ crimp outer attachment using standard hex crimp sizes.

• **Cable Assemblies** – All FBT-240 cable types are available as pre-terminated cable assemblies. Refer to the section on FlexTech for further details.

Part Description				
Part No.	Application	Jacket	Color	Stock Code
FBT-240	Indoor/Outdoor	FEP	Brown	54167

Construction Specifications			
Description	Material	In.	(mm)
Inner Conductor	Solid BC	0.051	(1.30)
Dielectric	Low Density PTFE	0.150	(3.81)
Outer Conductor	Aluminum Tape	0.155	(3.94)
Overall Braid	Tinned Copper	0.178	(4.52)
Jacket	Brown FEP	0.205	(5.21)

Mechanical Specifications

Performance Property	Units	US	(metric)
Bend Radius: installation	in. (mm)	1.0	(25.4)
Bend Radius: repeated	in. (mm)	2	(50.8)
Bending Moment	ft-lb (N-m)	0.25	(0.34)
Weight	lb/ft (kg/m)	0.040	(0.06)
Tensile Strength	lb (kg)	60	(27.2)
Flat Plate Crush	lb/in. (kg/mm)	85	(1.52)

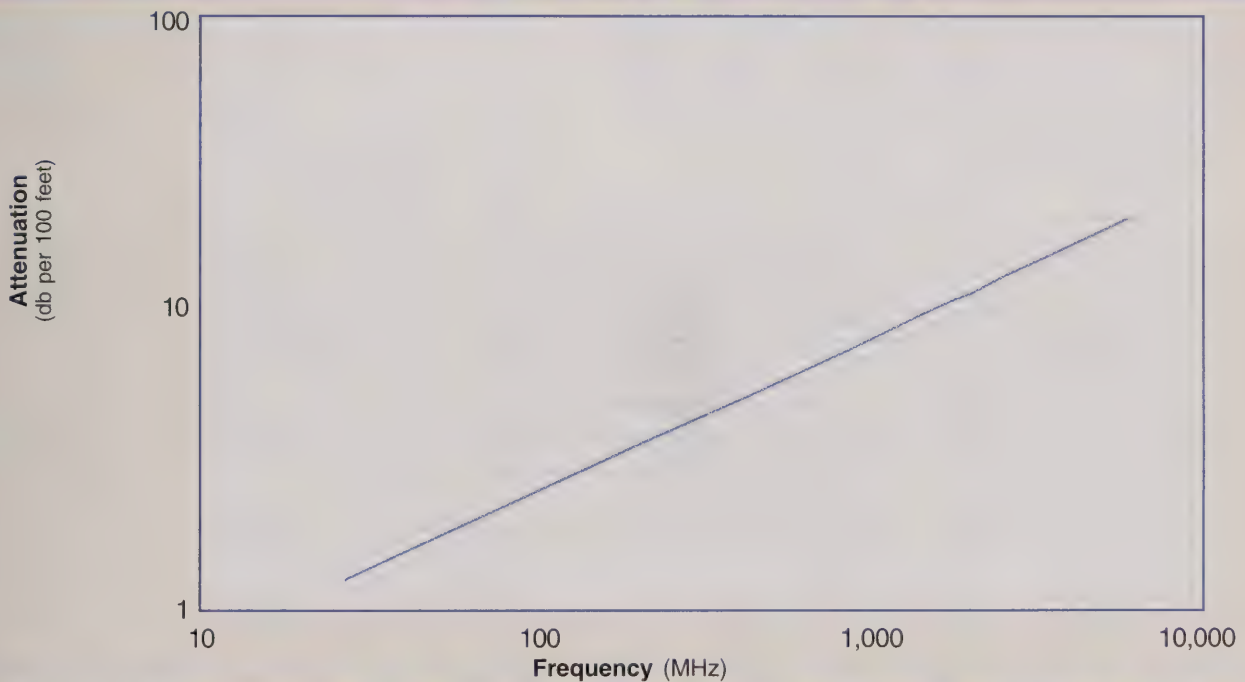
Environmental Specifications

Performance Property	°F	°C
Installation Temperature Range	-67/+302	-55/+150
Storage Temperature Range	-67/+302	-55/+150
Operating Temperature Range	-67/+302	-55/+150

Electrical Specifications

Performance Property	Units	US	(metric)
Cutoff Frequency	GHz	28	
Velocity of Propagation	%	76	
Dielectric Constant	NA	1.73	
Time Delay	nS/ft (nS/m)	1.34	(4.40)
Impedance	ohms	50	
Capacitance	pF/ft (pF/m)	26.7	(87.6)
Inductance	uH/ft (uH/m)	0.067	(0.22)
Shielding Effectiveness	dB	>90	
DC Resistance			
Inner Conductor	ohms/1000ft (/km)	4.00	(13.1)
Outer Conductor	ohms/1000ft (/km)	3.90	(12.8)
Voltage Withstand	Volts DC	1000	
Jacket Spark	Volts RMS	3000	
Peak Power	kW	5.6	

Attenuation vs. Frequency (typical)



Frequency (MHz)	30	50	150	220	450	900	1500	1800	2000	2500	3400	5800
Attenuation dB/100 ft	1.4	1.8	3.1	3.7	5.4	7.6	9.9	10.9	11.5	12.9	15.1	20.0
Attenuation dB/100 m	4.5	5.8	10.1	12.2	17.6	25.0	332.5	35.7	37.7	42.3	49.6	65.6
Avg. Power kW	2.48	1.92	1.10	0.91	0.63	0.44	0.34	0.31	0.29	0.26	0.22	0.17

Calculate Attenuation =

$(0.248515) \cdot \sqrt{\text{FMHz}} + (0.000183) \cdot \text{FMHz}$ (interactive calculator available at <http://www.timesmicrowave/telecom>)

Attenuation:

VSWR=1.0 ; Ambient = +25°C (77°F)

Power:

VSWR=1.0; Ambient = +40°C; Inner Conductor = 100°C (212°F); Sea Level; dry air; atmospheric pressure; no solar loading

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FBT-240

Flexible Low Loss High Power Communications Coax



Connectors

Interface	Description	Part Number	Stock Code	VSWR** Freq. (GHz)	Coupling Nut	Inner Contact Attach	Outer Contact Attach	Finish* Body /Pin	Length in (mm)	Width in (mm)	Weight lb (g)
N Male	Straight Plug	TC-240-NM	3190-382	<1.25:1 (2.5)	Hex	Solder	Crimp	NS	1.5 (38)	0.75 (19.1)	0.086 (39.0)
N Male	Straight Plug	TC-240-NMC	3190-244	<1.25:1 (2.5)	Knurl	Solder	Clamp	S/G	1.5 (38)	0.75 (19.1)	0.082 (37.2)
BNC Male	Straight Plug	TC-240-BMC	3190-242	<1.25:1 (2.5)	Knurl	Solder	Clamp	S/G	1.7 (43)	0.56 (14.2)	0.040 (18.1)
	Straight Plug	TC-240-BM(A)	3190-867	<1.25:1 (2.5)	Knurl	Solder	Crimp	A/G	1.7 (43)	0.56 (14.2)	0.043 (19.5)
TNC Male	Straight Plug	TC-240-TM	3190-275	<1.25:1 (2.5)	Knurl	Solder	Crimp	NS	1.7 (43)	0.59 (15.0)	0.043 (19.5)
TNC Male	Right Angle	TC-240-TM-RA	3190-604	<1.35:1 (2.5)	Knurl	Solder	Crimp	NG	1.3 (33)	0.57 (14.5)	0.055 (24.9)
SMA Male	Straight Plug	TC-240-SM	3190-380	<1.25:1 (10)	Hex	Solder	Crimp	SS/G	1.0 (25)	0.32 (8.1)	0.016 (7.3)
SMA Male	Right Angle	TC-240-SM-RA	3190-381	<1.35:1 (6)	Hex	Solder	Crimp	SS/G	0.8 (20)	0.65 (16.5)	0.019 (8.6)
SMA Female	Bulkhead Jack	TC-240-SF-BH	3190-824	<1.25:1 (2.5)	NA	Solder	Crimp	SS/G	1.1 (29)	0.31 (7.9)	0.019 (8.6)
SMA Rev. Polarity	Straight Plug	TC-240-SM-RP	3190-326	<1.25:1 (2.5)	Hex	Solder	Crimp	SS/G	1.0 (25)	0.32 (8.1)	0.016 (7.3)
Mini-UHF	Straight Plug	TC-240-MUHF	3190-445	<1.25:1 (2.5)	Knurl	Solder	Crimp	NG	1.1 (28)	0.45 (11.4)	0.014 (6.4)

* Finish metals: N=Nickel, S=Silver, G=Gold, SS=Stainless Steel, A=Alballoy **VSWR spec based on 3 foot cable with a connector pair



GK-S240T

Hardware Accessories

Type	Part Number	Stock Code	Description
Ground Kit	GK-S240T	GK-S240T	Standard Ground Kit (each)



CCT-01

Install Tools



CT-240/200/195/100

Type	Part Number	Stock Code	Description
Crimp Tool	CT-240/200/195/100	3190-667	Crimp tool for LMR-240 connectors
Cutting Tool	CCT-01	3190-1544	Cable and flush cut tool
Replacement Blades	RB-01	3190-1609	Replacement blades for cutting tool

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FTB-300

Flexible Low Loss High Power Communications Coax

Ideal for...

- High Power Base Station Jumper Assemblies
- In-Building Plenum Feeder Runs
- Any High Power Low Loss RF cable application



• **FTB**® is an indoor/outdoor highly fire retarded cable intended specifically for runs within and between base station cabinets. It is also applicable for return air handling plenums (e.g., dropped ceilings, raised floors). It has a UL/NEC & CSA rating of 'CMP/MPP' and 'FT6' respectively.

• **Flexibility** and bendability are hallmarks of the FBT-300 cable design. The flexible outer conductor enables the tightest bend radius available for any cable of similar size and performance.

• **Low Loss** is another hallmark feature of FBT-300. Size for size FBT has the lowest loss of any flexible cable and comparable loss to semirigid hard-line cables.

• **RF Shielding** is 50 dB greater than typical single shielded coax (40 dB). The multi-ply bonded foil outer conductor is rated conservatively at > 90 dB (i.e. >180 dB between two adjacent cables).

• **Weatherability**: FBT-300 cables designed for outdoor exposure incorporate Teflon® FEP jackets for UV resistance and have life expectancy in excess of 20 years.

• **Connectors**: A wide variety of connectors are available for FBT-300 cable, including all common interface types, reverse polarity, and a choice of solder or non-solder center pins. Most FBT connectors employ crimp outer attachment using standard hex crimp sizes.

• **Cable Assemblies** – All FBT-300 cable types are available as pre-terminated cable assemblies. Refer to the section on FlexTech for further details.

Construction Specifications			
Description	Material	In.	(mm)
Inner Conductor	Solid BC	0.063	(1.60)
Dielectric	Low Density PTFE	0.190	(4.83)
Outer Conductor	Aluminum Tape	0.196	(4.98)
Overall Braid	Tinned Copper	0.225	(5.72)
Jacket	Brown FEP	0.260	(6.60)

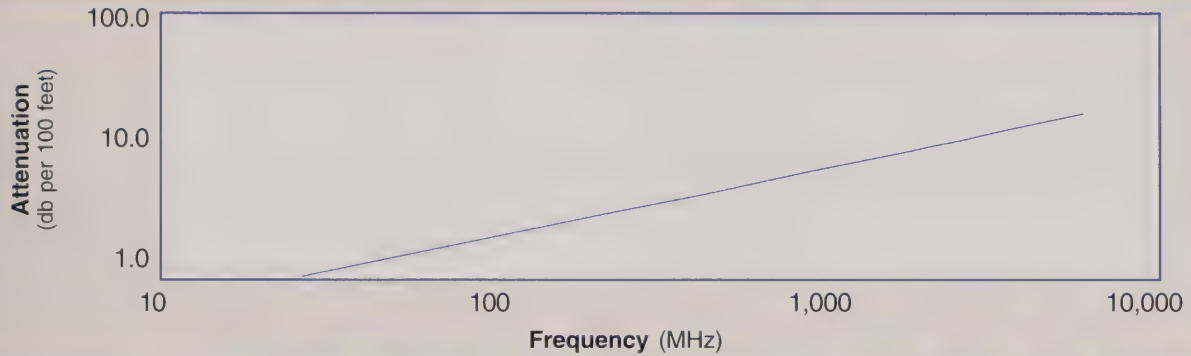
Mechanical Specifications			
Performance Property	Units	US	(metric)
Bend Radius: installation	in. (mm)	1.3	(31.8)
Bend Radius: repeated	in. (mm)	3	(76.2)
Bending Moment	ft-lb (N-m)	0.38	(0.52)
Weight	lb/ft (kg/m)	0.065	(0.10)
Tensile Strength	lb (kg)	120	(54.52)
Flat Plate Crush	lb/in. (kg/mm)	30	(0.54)

Environmental Specifications			
Performance Property	°F	°C	
Installation Temperature Range	-67/+302	-55/+150	
Storage Temperature Range	-67/+302	-55/+150	
Operating Temperature Range	-67/+302	-55/+150	

Electrical Specifications			
Performance Property	Units	US	(metric)
Cutoff Frequency	GHz	23	
Velocity of Propagation	%	76	
Dielectric Constant	NA	1.73	
Time Delay	nS/ft (nS/m)	1.34	(4.40)
Impedance	ohms	50	
Capacitance	pF/ft (pF/m)	26.7	(87.6)
Inductance	uH/ft (uH/m)	0.067	(0.22)
Shielding Effectiveness	dB	>90	
DC Resistance			
Inner Conductor	ohms/1000ft (/km)	2.61	(8.6)
Outer Conductor	ohms/1000ft (/km)	2.21	(7.3)
Voltage Withstand	Volts DC	2000	
Jacket Spark	Volts RMS	5000	
Peak Power	kW	10	

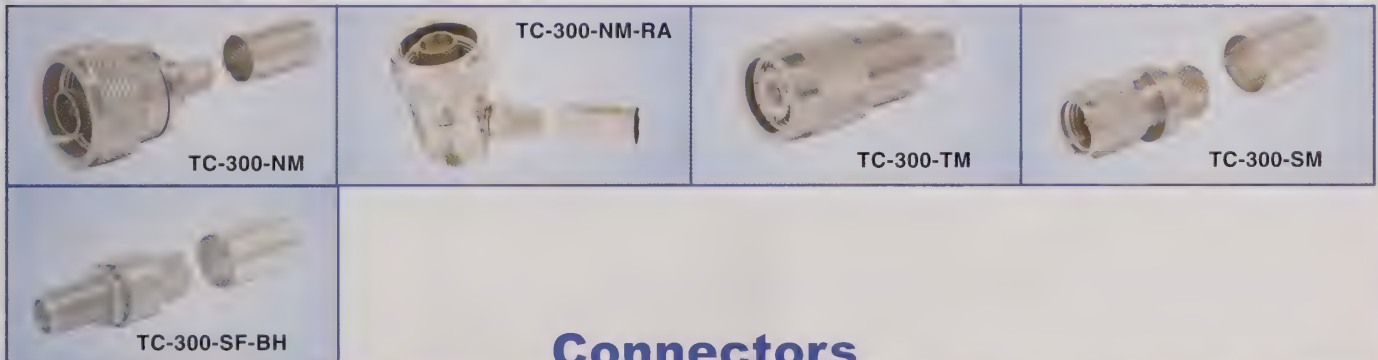
Part Description				
Part No.	Application	Jacket Color	Stock Code	
FTB-300	Indoor/Outdoor	FEP Brown	54168	

Attenuation vs. Frequency (typical)



Frequency (MHz)	30	50	150	220	450	900	1500	1800	2000	2500	3400	5800
Attenuation dB/100 ft	1.1	1.4	2.5	3.0	4.3	6.2	8.0	8.8	9.3	10.5	12.3	16.3
Attenuation dB/100 m	3.6	4.7	8.1	9.9	14.2	20.2	26.3	28.9	30.6	34.3	40.3	53.5
Avg. Power kW	3.44	2.67	1.53	1.26	0.87	0.61	0.47	0.43	0.40	0.36	0.30	0.23

Calculate Attenuation = $(0.200179) \cdot \sqrt{\text{FMHz}} + (0.000183) \cdot \text{FMHz}$ (interactive calculator available at <http://www.timesmicrowave/telecom>)
 Attenuation: VSWR=1.0; Ambient = +25°C (77°F) Power: VSWR=1.0; Ambient = +40°C; Inner Conductor = 100°C (212°F);
 Sea Level; dry air; atmospheric pressure; no solar loading



Connectors

Interface	Description	Part Number	Stock Code	VSWR** Freq. (GHz)	Coupling Nut	Inner Contact Attach	Outer Contact Attach	Finish* Body /Pin	Length in (mm)	Width in (mm)	Weight lb (g)
N Male	Straight Plug	TC-300-NM	3190-498	<1.25:1 (6)	Knurl	Solder	Crimp	NS	1.6 (41)	0.85 (21.6)	0.074 (33.8)
N Male	Right Angle	TC-300-NM-RA	3190-499	<1.35:1 (25)	Knurl	Solder	Crimp	NS	1.5 (38)	0.85 (21.6)	0.101 (45.8)
TNC Male	Straight Plug	TC-300-TM	3190-500	<1.25:1 (25)	Knurl	Solder	Crimp	NS	1.7 (43)	0.59 (15.0)	0.050 (22.7)
SMA Male	Straight Plug	TC-300-SM	3190-501	<1.25:1 (25)	Hex	Solder	Crimp	SS/G	1.0 (25)	0.35 (8.9)	0.018 (8.2)
SMA Female	Bulkhead Jack	TC-300-SF-BH	3190-590	<1.25:1 (25)	NA	Solder	Crimp	SS/G	1.1 (28)	0.31 (7.9)	0.022 (10.0)

* Finish metals: N=Nickel, S=Silver, G=Gold, SS=Stainless Steel, A=Alballoy **VSWR spec based on 3 foot cable with a connector pair

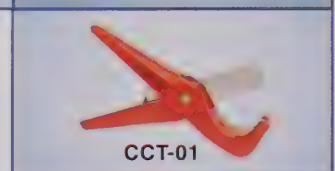
Hardware Accessories

Type	Part Number	Stock Code	Description
Ground Kit	GK-S300T	GK-S300T	Standard Ground Kit (each)



Install Tools

Type	Part Number	Stock Code	Description
Crimp Tool	CT-300/400	3190-666	Crimp tool for LMR 300 connectors
Cutting Tool	CCT-01	3190-1544	Cable and flush cut tool
Replacement Blades	RB-01	3190-1609	Replacement blades for cutting tool



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FBT-400

Flexible Low Loss High Power Communications Coax

Ideal for...

- High Power Base Station Jumper Assemblies
- In-Building Plenum Feeder Runs
- Any High Power Low Loss RF cable application



• **FBT®** is an indoor/outdoor highly fire retarded cable intended specifically for runs within and between base station cabinets. It is also applicable for return air handling plenums (e.g., dropped ceilings, raised floors). It has a UL/NEC & CSA rating of 'CMP/MPP' and 'FT6' respectively.

• **Flexibility** and bendability are hallmarks of the FBT-400 cable design. The flexible outer conductor enables the tightest bend radius available for any cable of similar size and performance.

• **Low Loss** is another hallmark feature of FBT-400. Size for size FBT has the lowest loss of any flexible cable and comparable loss to semirigid hard-line cables.

• **RF Shielding** is 50 dB greater than typical single shielded coax (40 dB). The multi-ply bonded foil outer conductor is rated conservatively at > 90 dB (i.e. >180 dB between two adjacent cables).

• **Weatherability:** FBT-400 cables designed for outdoor exposure incorporate Teflon® FEP jackets for UV resistance and have life expectancy in excess of 20 years.

• **Connectors:** A wide variety of connectors are available for FBT-400 cable, including all common interface types, reverse polarity, and a choice of solder or non-solder center pins. Most FBT connectors employ crimp outer attachment using standard hex crimp sizes.

• **Cable Assemblies** – All FBT-400 cable types are available as pre-terminated cable assemblies. Refer to the section on FlexTech for further details.

Part Description				Stock
Part No.	Application	Jacket	Color	Code
FBT-400	Indoor/Outdoor	FEP	Brown	54171

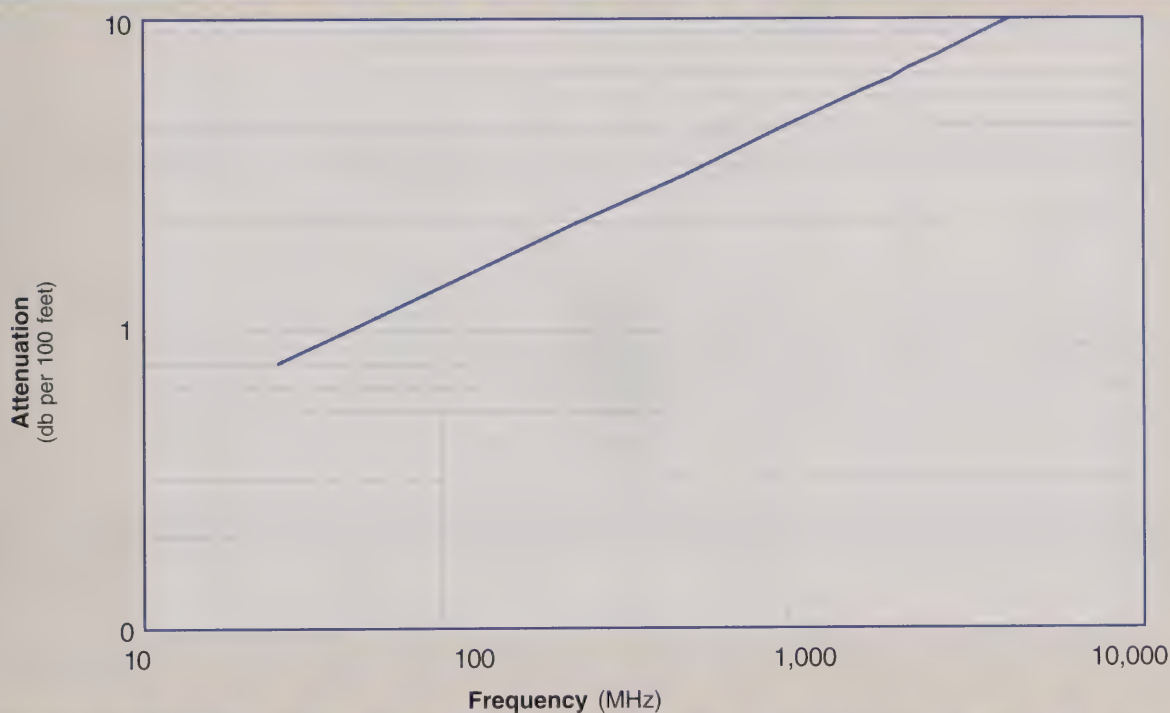
Construction Specifications			
Description	Material	In.	(mm)
Inner Conductor	Solid BCCAl	0.095	(2.41)
Dielectric	Low Density PTFE	0.285	(7.24)
Outer Conductor	Aluminum Tape	0.291	(7.39)
Overall Braid	Tinned Copper	0.320	(8.13)
Jacket	Brown FEP	0.370	(9.40)

Mechanical Specifications			
Performance Property	Units	US	(metric)
Bend Radius: installation	in. (mm)	1.8	(44.5)
Bend Radius: repeated	in. (mm)	4	(101.6)
Bending Moment	ft-lb (N-m)	1	(1.36)
Weight	lb/ft (kg/m)	0.104	(0.15)
Tensile Strength	lb (kg)	120	(54.5)
Flat Plate Crush	lb/in. (kg/mm)	185	(3.31)

Environmental Specifications			
Performance Property	'F	'C	
Installation Temperature Range	-67/+302	-55/+150	
Storage Temperature Range	-67/+302	-55/+150	
Operating Temperature Range	-67/+302	-55/+150	

Electrical Specifications			
Performance Property	Units	US	(metric)
Cutoff Frequency	GHz	15	
Velocity of Propagation	%	76	
Dielectric Constant	NA	1.73	
Time Delay	nS/ft (nS/m)	1.34	(4.40)
Impedance	ohms	50	
Capacitance	pF/ft (pF/m)	26.7	(87.6)
Inductance	uH/ft (uH/m)	0.067	(0.22)
Shielding Effectiveness	dB	>90	
DC Resistance			
Inner Conductor	ohms/1000ft (/km)	1.80	(5.9)
Outer Conductor	ohms/1000ft (/km)	1.65	(5.4)
Voltage Withstand	Volts DC	2500	
Jacket Spark	Volts RMS	8000	
Peak Power	kW	16	

Attenuation vs. Frequency (typical)



Frequency (MHz)	30	50	150	220	450	900	1500	1800	2000	2500	3400	5800
Attenuation dB/100 ft	0.7	0.9	1.6	1.9	2.8	4.0	5.2	5.7	6.1	6.8	8.0	10.7
Attenuation dB/100 m	2.3	3.0	5.3	6.4	9.2	13.1	17.1	18.8	19.9	22.4	26.3	35.0
Avg. Power kW	6.23	4.82	2.76	2.27	1.58	1.10	0.84	0.77	0.73	0.65	0.55	0.41

Calculate Attenuation =

$(0.129138) \cdot \sqrt{\text{FMHz}} + (0.000146) \cdot \text{FMHz}$ (interactive calculator available at <http://www.timesmicrowave/telecom>)

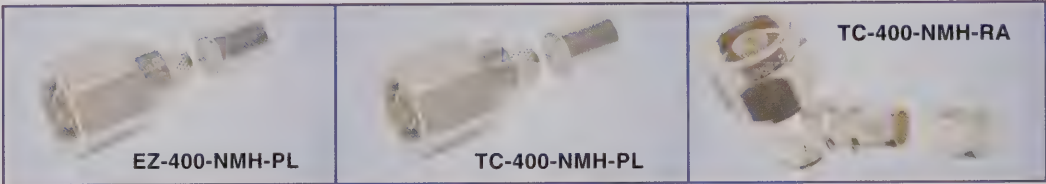
Attenuation:

VSWR=1.0 ; Ambient = +25°C (77°F)

Power:

VSWR=1.0; Ambient = +40°C; Inner Conductor = 100°C (212°F); Sea Level; dry air; atmospheric pressure; no solar loading

FBT-400 **Flexible Low Loss High Power Communications Coax**



Connectors

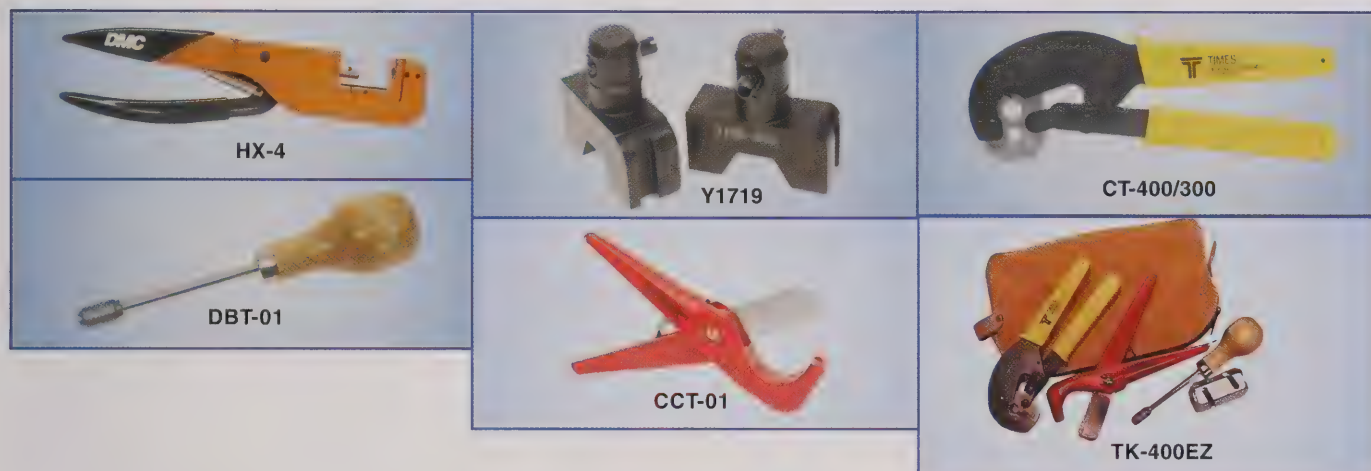
Interface	Description	Part Number	Stock Code	VSWR** Freq. (GHz)	Coupling Nut	Inner Contact Attach	Outer Contact Attach	Finish* Body /Pin	Length in (mm)	Width in (mm)	Weight lb (g)
N Male	Straight Plug	EZ-400-NMH-PL	3190-602	<1.25:1 (2.5)	Hex	Spring Finger	Clamp	S/G	1.5 (38)	0.89 (22.6)	0.113 (51.3)
	Straight Plug	TC-400-NMH-PL	3190-759	<1.25:1 (2.5)	Hex	Solder	Crimp	S/G	1.5 (38)	0.89 (22.6)	0.113 (51.3)
	Right Angle	TC-400-NMH-RA	3190-422	<1.35:1 (6)	Hex	Solder	Crimp	S/G	1.8 (46)	1.25 (31.8)	0.130 (59.0)

* Finish metals: N=Nickel, S=Silver, G=Gold, SS=Stainless Steel, A=Alloy **VSWR spec based on 3 foot cable with a connector pair



Hardware Accessories

Type	Part Number	Stock Code	Description
Ground Kit	GK-S400T	GK-S400T	Standard Grounding Kit (each)



Install Tools

Type	Part Number	Stock Code	Description
Crimp Tool	HX-4	3190-200	Crimp Handle
Crimp Dies	Y1719	3190-202	.429" Hex Dies
Crimp Tool	CT-400/300	3190-666	Crimp tool for LMR 400 connectors
Crimp Rings	CR-400	3190-830	Crimp rings for TC/EZ-400 connectors (package of 10)
Deburr Tool	DBT-01	3190-406	For 'EZ' Style Connectors
Cutting Tool	CCT-01	3190-1544	Cable and flush cut tool
Replacement Blades	RB-01	3190-1609	Replacement blades for cutting tool
Tool Kit	TK-400EZ	3190-1602	Tool kit for LMR-400 Crimp Connectors (includes CCT-01, ST-400EZ, CT-400/300, DBT-01, Tool Pouch)

TIMES MICROWAVE SYSTEMS

A Smiths Group plc company

FBT-500

Flexible Low Loss High Power Communications Coax

Ideal for...

- High Power Base Station Jumper Assemblies
- In-Building Plenum Feeder Runs
- Any High Power Low Loss RF cable application



• **FBT®** is an indoor/outdoor highly fire retarded cable intended specifically for runs within and between base station cabinets. It is also applicable for return air handling plenums (e.g., dropped ceilings, raised floors). It has a UL/NEC & CSA rating of 'CMP/MPP' and 'FT6' respectively.

• **Flexibility** and bendability are hallmarks of the FBT-500 cable design. The flexible outer conductor enables the tightest bend radius available for any cable of similar size and performance.

• **Low Loss** is another hallmark feature of FBT-500. Size for size FBT has the lowest loss of any flexible cable and comparable loss to semirigid hard-line cables.

• **RF Shielding** is 50 dB greater than typical single shielded coax (40 dB). The multi-ply bonded foil outer conductor is rated conservatively at > 90 dB (i.e. >180 dB between two adjacent cables).

• **Weatherability:** FBT-500 cables designed for outdoor exposure incorporate Teflon® FEP jackets for UV resistance and have life expectancy in excess of 20 years.

• **Connectors:** A wide variety of connectors are available for FBT-500 cable, including all common interface types, reverse polarity, and a choice of solder or non-solder center pins. Most FBT connectors employ crimp outer attachment using standard hex crimp sizes.

• **Cable Assemblies** – All FBT-500 cable types are available as pre-terminated cable assemblies. Refer to the section on FlexTech for further details.

Construction Specifications			
Description	Material	In.	(mm)
Inner Conductor	Solid BCCAl	0.123	(3.12)
Dielectric	Low Density PTFE	0.370	(9.40)
Outer Conductor	Aluminum Tape	0.376	(9.55)
Overall Braid	Tinned Copper	0.405	(10.29)
Jacket	Brown FEP	0.465	(11.81)

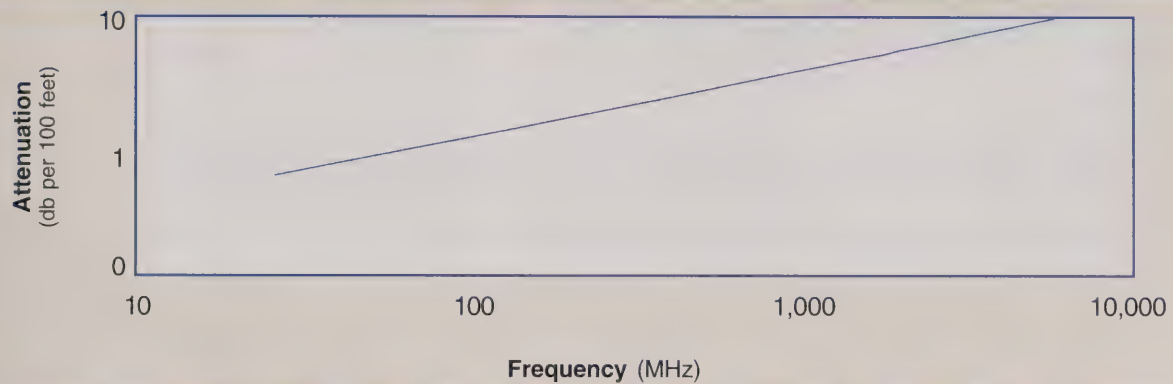
Mechanical Specifications			
Performance Property	Units	US	metric
Bend Radius: installation	in. (mm)	2.3	(57.2)
Bend Radius: repeated	in. (mm)	5	(127.0)
Bending Moment	ft-lb (N-m)	1.75	(2.37)
Weight	lb/ft (kg/m)	0.104	(0.15)
Tensile Strength	lb (kg)	120	(54.5)
Flat Plate Crush	lb/in. (kg/mm)	185	(3.31)

Environmental Specifications			
Performance Property	°F	°C	
Installation Temperature Range	-67/+302	-55/+150	
Storage Temperature Range	-67/+302	-55/+150	
Operating Temperature Range	-67/+302	-55/+150	

Electrical Specifications			
Performance Property	Units	US	(metric)
Cutoff Frequency	GHz	11.6	
Velocity of Propagation	%	76	
Dielectric Constant	NA	1.73	
Time Delay	nS/ft (nS/m)	1.34	(4.40)
Impedance	ohms	50	
Capacitance	pF/ft (pF/m)	26.7	(87.6)
Inductance	uH/ft (uH/m)	0.067	(0.22)
Shielding Effectiveness	dB	>90	
DC Resistance			
Inner Conductor	ohms/1000ft (/km)	1.09	(3.6)
Outer Conductor	ohms/1000ft (/km)	1.27	(4.2)
Voltage Withstand	Volts DC	3000	
Jacket Spark	Volts RMS	8000	
Peak Power	kW	11.6	

Part Description				
Part No.	Application	Jacket	Color	Stock Code
FBT-500	Indoor/Outdoor	FEP	Brown	54172

Attenuation vs. Frequency (typical)



Frequency (MHz)	30	50	150	220	450	900	1500	1800	2000	2500	3400	5800
Attenuation dB/100 ft	0.6	0.7	1.2	1.5	2.2	3.1	4.1	4.5	4.8	5.4	6.3	8.5
Attenuation dB/100 m	1.8	2.3	4.1	5.0	7.2	10.3	13.5	14.8	15.7	17.6	20.8	27.8
Avg. Power kW	8.90	6.88	3.94	3.24	2.24	1.56	1.20	1.08	1.03	0.91	0.77	0.57

Calculate Attenuation = $(0.100255) \cdot \sqrt{\text{FMHz}} + (0.000146) \cdot \text{FMHz}$ (interactive calculator available at <http://www.timesmicrowave/telecom>)
 Attenuation: VSWR=1.0; Ambient = +25°C (77°F) Power: VSWR=1.0; Ambient = +40°C; Inner Conductor = 100°C (212°F);
 Sea Level; dry air; atmospheric pressure; no solar loading



TC-500-NMC-PL

Connectors

Interface	Description	Part Number	Stock Code	VSWR** Freq. (GHz)	Coupling Nut	Inner Contact Attach	Outer Contact Attach	Finish* Body /Pin	Length in (mm)	Width in (mm)	Weight lb (g)
N/Male	Straight Plug	TC-500-NMC-PL	3190-900	<1.25:1 (25)	Hex	Solder	Clamp	S/G	2.1 (53)	0.92 (23.4)	0.228 (103.4)

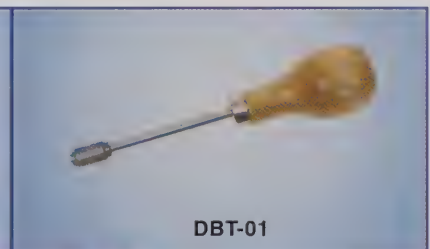
* Finish metals: N=Nickel, S=Silver, G=Gold, SS=Stainless Steel, A=Alballoy **VSWR spec based on 3 foot cable with a connector pair



HX-4



Y151



DBT-01

Install Tools

Type	Part Number	Stock Code	Description
Crimp Tool	HX-4	3190-200	Crimp Handle
Crimp Dies	Y151	3190-465	.532" Hex Dies
Deburr Tool	DBT-01	3190-406	Removes center conductor rough edges
Cutting Tool	CCT-01	3190-1544	Cable end flush cut tool
Replacement Blades	RB-01	3190-1609	Replacement blades for cutting tool



CCT-01

TIMES MICROWAVE SYSTEMS

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FBT-600

Flexible Low Loss High Power Communications Coax

Ideal for...

- High Power Base Station Jumper Assemblies
- In-Building Plenum Feeder Runs
- Any High Power Low Loss RF cable application



• **FBT®** is an indoor/outdoor highly fire retarded cable intended specifically for runs within and between base station cabinets. It is also applicable for return air handling plenums (e.g., dropped ceilings, raised floors). It has a UL/NEC & CSA rating of 'CMP/MPP' and 'FT6' respectively.

• **Flexibility** and bendability are hallmarks of the FBT-600 cable design. The flexible outer conductor enables the tightest bend radius available for any cable of similar size and performance.

• **Low Loss** is another hallmark feature of FBT-600. Size for size FBT has the lowest loss of any flexible cable and comparable loss to semirigid hard-line cables.

• **RF Shielding** is 50 dB greater than typical single shielded coax (40 dB). The multi-ply bonded foil outer conductor is rated conservatively at > 90 dB (i.e. >180 dB between two adjacent cables).

• **Weatherability:** FBT-600 cables designed for outdoor exposure incorporate Teflon® FEP jackets for UV resistance and have life expectancy in excess of 20 years.

• **Connectors:** A wide variety of connectors are available for FBT-600 cable, including all common interface types, reverse polarity, and a choice of solder or non-solder center pins. Most FBT connectors employ crimp outer attachment using standard hex crimp sizes.

• **Cable Assemblies** – All FBT-600 cable types are available as pre-terminated cable assemblies. Refer to the section on FlexTech for further details.

Part Description				Stock
Part No.	Application	Jacket	Color	Code
FBT-600	Indoor/Outdoor	FEP	Brown	54173

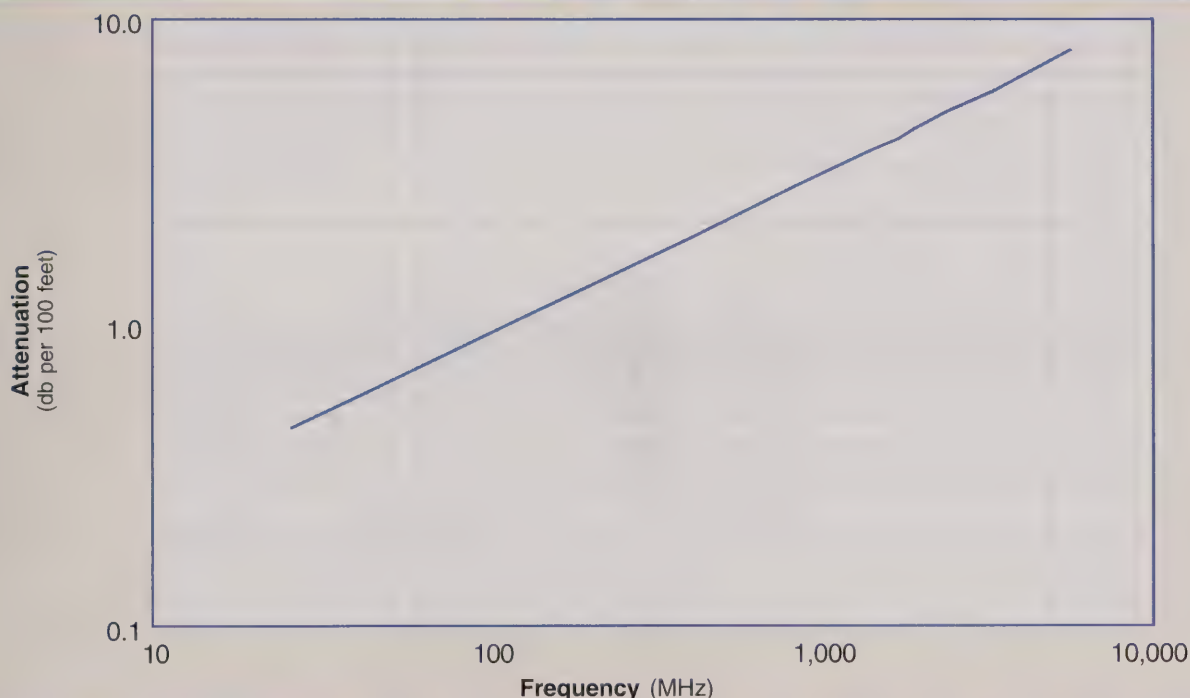
Construction Specifications			
Description	Material	In.	(mm)
Inner Conductor	Solid BCCAl	0.150	(3.81)
Dielectric	Low Density PTFE	0.455	(11.56)
Outer Conductor	Aluminum Tape	0.461	(11.71)
Overall Braid	Tinned Copper	0.490	(12.45)
Jacket	Brown FEP	0.565	(14.38)

Mechanical Specifications			
Performance Property	Units	US	(metric)
Bend Radius: installation	in. (mm)	2.8	(69.9)
Bend Radius: repeated	in. (mm)	6	(152.4)
Bending Moment	ft-lb (N-m)	2.75	(3.73)
Weight	lb/ft (kg/m)	0.210	(0.31)
Tensile Strength	lb (kg)	265	(120.3)
Flat Plate Crush	lb/in. (kg/mm)	210	(3.75)

Environmental Specifications		
Performance Property	°F	°C
Installation Temperature Range	-67/+302	-55/+150
Storage Temperature Range	-67/+302	-55/+150
Operating Temperature Range	-67/+302	-55/+150

Electrical Specifications			
Performance Property	Units	US	(metric)
Cutoff Frequency	GHz	9.4	
Velocity of Propagation	%	76	
Dielectric Constant	NA	1.73	
Time Delay	nS/ft (nS/m)	1.34	(4.40)
Impedance	ohms	50	
Capacitance	pF/ft (pF/m)	26.7	(87.6)
Inductance	uH/ft (uH/m)	0.067	(0.22)
Shielding Effectiveness	dB	>90	
DC Resistance			
Inner Conductor	ohms/1000ft (/km)	0.73	(2.4)
Outer Conductor	ohms/1000ft (/km)	1.20	(3.9)
Voltage Withstand	Volts DC	4000	
Jacket Spark	Volts RMS	8000	
Peak Power	kW	40	

Attenuation vs. Frequency (typical)



Frequency (MHz)	30	50	150	220	450	900	1500	1800	2000	2500	3400	5800
Attenuation dB/100 ft	0.5	0.6	1.0	1.2	1.8	2.6	3.4	3.7	3.9	4.4	5.2	7.0
Attenuation dB/100 m	1.5	1.9	3.3	4.1	5.9	8.4	11.1	12.2	12.9	14.5	17.2	23.1
Avg. Power kW	11.84	9.14	5.23	4.30	2.97	2.07	1.57	1.43	1.35	1.20	1.01	0.75

Calculate Attenuation =

$(0.081389) \cdot \sqrt{\text{FMHz}} + (0.000146) \cdot \text{FMHz}$ (interactive calculator available at <http://www.timesmicrowave/telecom>)

Attenuation:

VSWR=1.0 ; Ambient = +25°C (77°F)

Power:

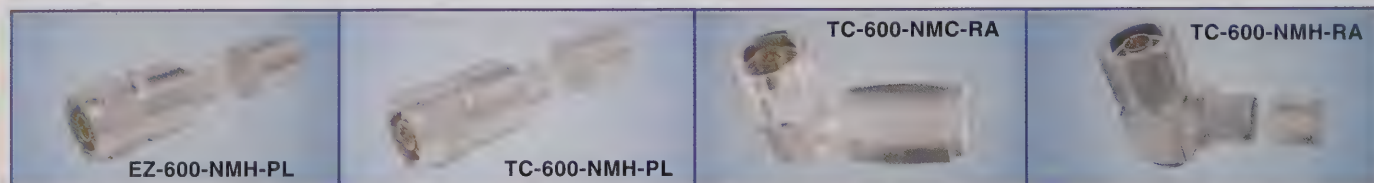
VSWR=1.0; Ambient = +40°C; Inner Conductor = 100°C (212°F); Sea Level; dry air; atmospheric pressure; no solar loading

TIMES MICROWAVE SYSTEMS

A Smiths Group plc company

FBT-600

Flexible Low Loss High Power Communications Coax



Connectors

Interface	Description	Part Number	Stock Code	VSWR** Freq. (GHz)	Coupling Nut	Inner Contact Attach	Outer Contact Attach	Finish* Body /Pin	Length in (mm)	Width in (mm)	Weight lb (g)
N Male	Straight Plug	EZ-600-NMH-PL	3190-603	<1.25:1 (2.5)	Hex	Spring Finger	Crimp	S/G	2.1 (53)	0.92 (23.4)	0.166 (75.3)
	Straight Plug	TC-600-NMH-PL	3190-760	<1.25:1 (2.5)	Hex	Solder	Crimp	S/G	2.1 (53)	0.92 (23.4)	0.208 (93.4)
	Right Angle	TC-600-NMC-RA	3190-233	<1.35:1 (2.5)	Hex	Solder	Clamp	SG	2.1 (53)	0.92 (23.4)	0.280 (127.9)
	Right Angle	TC-600-NMH-RA	3190-785	<1.35:1 (2.5)	Hex	Solder	Crimp	SG	2.1 (53)	0.92 (23.4)	0.185 (83.9)

* Finish metals: N=Nickel, S=Silver, G=Gold, SS=Stainless Steel, A=Alballoy **VSWR spec based on 3 foot cable with a connector pair



Hardware Accessories

Type	Part Number	Stock Code	Description
Ground Kit	GK-S600T	GK-S600T	Standard Grounding Kit (each)



Install Tools

Type	Part Number	Stock Code	Description
Crimp Tool	HX-4	3190-200	Crimp Handle
Crimp Dies	Y1720	3190-203	.610" Hex Dies
Crimp Rings	CR-600	3190-831	Crimp Rings for TC/EZ-600 connectors (pkg of 10)
Deburr Tool	DBT-01	3190-406	Removes center conductor rough edges
Midspan Strip Tool	GST-600A	3190-1051	For ground strap attachment
Tool Kit	TK-600EZ	3190-1602	Tool kit for LMR-600 Crimp Connectors (includes CCT-01, ST-600EZ, HX-4, Y1720, DBT-01, Tool Pouch)
Cutting Tool	CCT-01	3190-1544	Cable end flush cut tool
Replacement Blades	RB-01	3190-1609	Replacement blades for cutting tool

FlexTech Commercial Cable Assemblies



Performance:

The use of higher frequencies for telecommunications applications has placed increasingly rigorous demands on cable assembly performance. Our 50 year plus background in military microwave assemblies has provided us the expertise to address these performance requirements, while our commercial expertise allows us to provide economical solutions.

Testing:

- VSWR or Return Loss
- Insertion Loss
- Time Delay
- Absolute or Relative Phase Matching
- Phase Trimming

Value Added

- Variety of Strain Relief Boots
- Multitude of Labeling Possibilities
- Bar Coding
- Customized Packaging

Connector Specifications: *FlexTech™* cable assemblies can be furnished with virtually any connector interface.

Gold Band Assemblies are made with the highest quality connectors. These connectors are mechanically rugged and optimized through design and tight tolerances to provide low VSWR across all frequency bands. With Times Microwave Systems' Gold Band assemblies, a maximum 1.25:1



Cable Specifications: *FlexTech*TM jumper assemblies are furnished standard with LMR-DB cable unless otherwise requested. Cable performance characteristics are listed in the section for each individual cable size. The following table summarizes the characteristics of general interest.

Cable Type	LMR-400	LMR-600	LMR-900
Diameter	.405"	.590"	.870"
Impedance	50 Ohms		
Bend Radius	1"	1-1/2"	3"
Weight(lbs/ft)	.068	.131	.266
Temperature	-40°C to +85°C		

VSWR in the 2.4 GHz band and a 1.35:1 VSWR in the 6 GHz band are assured. This performance insures the absolute lowest insertion loss possible for the chosen cable size.

Silver Band Assemblies (available for large volume applications) are made with our standard quality connectors. The Silver Band connectors are mechanically rugged and provide acceptable performance in the listed bands. They provide a maximum 1.35:1 VSWR in the 2.4 GHz band and a 1.50:1 VSWR in the 6 GHz band.

Assembly Part Numbers Definition

Cable Type Cable Length Performance Band
 LMR-400-DB/3ft/Nm/Nm/G
 Connector 1 Connector 2

LMR-xxx	ft	S/G
LMR-xxx-FR	in	See available connectors for the particular cable
LMR-xxx-LLPL	m	
LMR-xxx-UF	cm	
LMR-xxx-W		
LMR-xxx-DB		

TIMES MICROWAVE SYSTEMS

A Smiths Group plc company

FlexTech Commercial Cable Assemblies

Cable	Connectors	Length (ft)	Bend Rad. (in)	Max. Insertion Loss at 2450 MHz (dB)		Max. Insertion Loss at 5875 MHz (dB)	
				Gold	Silver	Gold	Silver
LMR-200-DB							
Diameter: 0.195"	Nm, NmRA, Nf, NfB	3	0.50	0.60	0.70	1.00	1.20
Jacket material:	NmRP, Tm, Tf	5	0.50	0.95	1.05	1.55	1.75
Polyethylene	TmRP, TIRP, Sm,	10	0.50	1.70	1.80	2.85	3.05
Color:	SmRA, SIB	15	0.50	2.50	2.60	4.20	4.40
Black or white		20	0.50	3.50	3.60	5.50	5.70
		25	0.50	4.30	4.40	6.85	7.05
		30	0.50	5.15	5.25	8.15	8.35
		35	0.50	5.95	6.05	9.50	9.70
		40	0.50	6.80	6.90	10.80	11.00
		45	0.50	7.65	7.75	12.15	12.35
		50	0.50	8.45	8.55	13.45	13.65
LMR-240-DB							
Diameter: 0.240"	Nm, NmRA, Nf, NfB	3	0.75	0.48	0.58	0.80	1.00
Jacket material:	MnRP, Tm, TmRP,	5	0.75	0.75	0.85	1.25	1.45
Polyethylene	Sm, SmRA, SIB	10	0.75	1.40	1.50	2.25	2.45
Color:		15	0.75	2.05	2.15	3.30	3.50
Black or white		20	0.75	2.70	2.80	4.30	4.50
		25	0.75	3.30	3.40	5.35	5.55
		30	0.75	4.00	4.10	6.35	6.55
		35	0.75	4.60	4.70	7.40	7.60
		40	0.75	5.25	5.35	8.40	8.60
		45	0.75	5.90	6.00	9.45	9.65
		50	0.75	6.50	6.60	10.45	10.65
LMR-400-DB							
Diameter: 0.405"	Nm, NmRA, Nf, NfB	3	1.00	0.30	0.40	0.55	0.75
Jacket material:	NmRP, Tm, TmRP	10	1.00	0.80	0.90	1.30	1.50
Polyethylene	Sm, Dm, Df	15	1.00	1.10	1.20	1.85	2.05
Color:		20	1.00	1.45	1.55	2.40	2.60
Black or white		25	1.00	1.80	1.90	2.95	3.15
		30	1.00	2.15	2.25	3.50	3.70
		35	1.00	2.45	2.55	4.00	4.20
		40	1.00	2.80	2.90	4.55	4.75
		45	1.00	3.15	3.25	5.10	5.30
		50	1.00	3.45	3.55	5.65	5.85
		55	1.00	3.80	3.90	6.20	6.40
		60	1.00	4.15	4.25	6.75	6.95
		65	1.00	4.45	4.55	7.30	7.50
		70	1.00	4.80	4.90	7.85	8.05
		75	1.00	5.15	5.25	8.40	8.60
LMR-600-DB							
Diameter: 0.590"	Nm, NmRA, Nf, NfB	3	1.50	0.25	0.35	0.40	0.60
Jacket material:	NmRP, Tm, TmRP	10	1.5	0.55	0.65	0.95	1.15
Polyethylene	Dm, Df	20	1.5	1.00	1.10	1.65	1.85
Color: Black		25	1.5	1.20	1.30	2.05	2.25
		30	1.5	1.45	1.55	2.40	2.60
		35	1.5	1.65	1.75	2.75	2.95
		40	1.5	1.90	2.00	3.15	3.35
		45	1.5	2.10	2.20	3.50	3.70
		50	1.5	2.20	2.30	3.85	4.05
		75	1.5	3.40	3.50	5.70	5.90
		100	1.5	4.50	4.60	7.50	7.70
		125	1.5	5.60	5.70	9.35	9.55
		150	1.5	6.70	6.80	11.15	11.35
		175	1.5	7.80	7.90	13.00	13.20
		200	1.5	8.90	9.00	14.80	15.00
LMR-900-DB							
Diameter: 0.870"	Nm, Nf, Dm, Df	10	3.0	0.40	*	0.70	*
Jacket material:		25	3.0	0.85	*	1.45	*
Polyethylene		50	3.0	1.55	*	1.65	*
Color: Black		75	3.0	2.30	*	3.90	*
		100	3.0	3.00	*	5.10	*
		125	3.0	3.75	*	6.35	*
		150	3.0	4.45	*	7.55	*
		250	3.0	7.35	*	12.45	*
		200	3.0	5.90	*	10.00	*
		300	3.0	8.80	*	14.90	*
*LMR 900 assemblies supplied with gold band connectors only							

*LMR 900 assemblies supplied
with gold band connectors only

Commercial Jumper Cables and Assemblies

Competitively Priced

Times Microwave Systems offers value engineered solutions. We manufacture more types of 50 ohm coaxial cable than anyone else in the world and stock hundreds of our own connector designs. We produce cable assemblies in the U.S. and China.

The Right Cable for the Application

Assemblies are built from one of the different LMR® cables or one of our many other specially optimized cables. Following is a listing of some of our commercial cable assembly customers:

Motorola	Ericsson	Cabletron	Cisco Systems	Lucent
GE Medical	Metricom	Novellus	Aperto Networks	Clearwire Technologies
Powerwave	Applied Materials	Flarion	Nextel	

Specialized WLAN Assemblies

Competitively Priced

The cable assembly list below has been developed to provide a quick cross reference to a Times Microwave Systems part number for some of the more common configurations being used for WLAN applications. Any of these assemblies ordered by the TMS part number in the right hand column will be 100% tested for IL and VSWR in the relevant brand.

Equipment OEM	OEM part # or model	Cable	Length	Connector 1	Connector 2	TMS part #
Agere		LMR-400-DB	50'	Nm	Nm	AE14563
Agere		LMR-400-DB	75'	Nm	Nm	AE14564
Alvarion/Breezecom		LMR-195-DB	3'	Nt	Sm RA cust.	AE14564
Alvarion/Breezecom		LMR-195-DB	20'	Nt	SM RA cust.	AE14566
Alvarion/Breezecom		LMR-195-DB	50'	Nt	Sm. RA cust.	AE14567
Alvarion/Breezecom		LMR-195-DB	75'	Nt	Sm. RA cust.	AE14568
Alvarion/Breezecom		LMR-195-DB	100'	Nt	Sm. RA cust.	AE14569
Alvarion/Breezecom		LMR-195-DB	3'	Nm	Sm. RA cust.	AE14570
Alvarion/Breezecom		LMR-195-DB	20'	Nm	Sm. RA cust.	AE14571
Alvarion/Breezecom		LMR-195-DB	50'	Nm	Sm. RA cust.	AE14572
Alvarion/Breezecom		LMR-195-DB	75'	Nm	Sm. RA cust.	AE14573
Alvarion/Breezecom		LMR-195-DB	100'	Nm	Sm. RA cust.	AE14574
Cisco/Aironet		LMR-200-DB	5'	TNCm RP	TNCf RP	AE14575
Cisco/Aironet		LMR-200-DB	10'	TNCm RP	TNCf RP	AE14576
Cisco/Aironet	72-2760-02	LMR-400-DB	20'	TNCm RP	TNCf RP	AE14577
Cisco/Aironet	72-2760-02	LMR-400-DB	50'	TNCm RP	TNCf RP	AE14578
Cisco/Aironet		LMR-600-DB	20'	TNCm RP	TNCf RP	AE14579
Cisco/Aironet		LMR-600-DB	50'	TNCm RP	TNCf RP	AE14580
Cisco/Aironet	72-2766-02	LMR-600-DB	100'	TNCm RP	TNCf RP	AE14581
Cisco/Aironet	72-2787-02	LMR-600-DB	150'	TNCm RP	TNCf RP	AE14582
Enterasy/Cabletron	CSIES-AB-C20	LMR-200-DB	20'	Nm	Nm	AE14583
Enterasy/Cabletron	CSIES-AA-C20	LMR-200-DB	20'	Nm RP	Nm RP	AE14584
Enterasy/Cabletron	CSIES-AB-C50	LMR-400-DB	50'	Nm	Nm	AE14563
Enterasy/Cabletron	CSIES-AA-C50	LMR-400-DB	50'	Nm RP	Nm RP	AE14585
Enterasy/Cabletron	CSIES-AB-C50	LMR-400-DB	75'	Nm	Nm	AE14564
Enterasy/Cabletron	CSIES-AA-C50	LMR-400-DB	75'	Nm RP	Nm RP	AE14586
Orinoco		LMR-100	2'	WaveLANm RA	Nt	AE14587
Orinoco		LMR-100	2'	WaveLANm RA	Nm	AE14588
Proxim		LMR-195-DB	3'	Sm RP	Nf	AE14589
Proxim		LMR-195-DB	3'	Sm RP	Nm	AE14590
Proxim		LMR-100	2'	mmcx RA m	Nf	AE14592
Symbol		LMR-195-DB	3'	BNCm RP	Nf	AE14592
Symbol		LMR-195-DB	3'	BNCm RP	Nm	AE14593

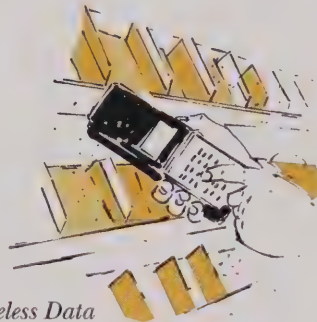
For All Your Flexible Coax Needs



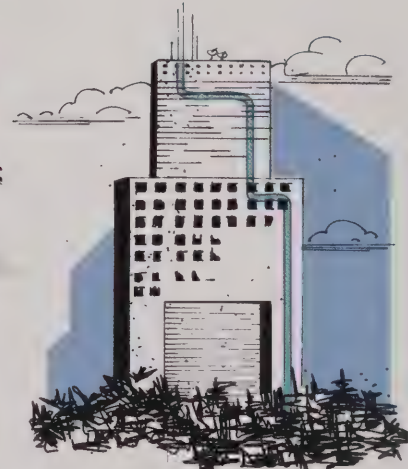
In Building Communications



Distributed Communications



Wireless Data



*Building Top
Wireless Cellular/PCS/WLL/LMDS*

TIMES Microwave has it:

- LMR® Flexible Low Loss Coax
- LMR®-DB Flexible Watertight Coax
- LMR®-FR Riser Rated Coax (UL/NEC 'CATVR', CSA)
- LMR®-FR-DB Watertight Riser Rated Coax (UL/NEC 'CATVR', CSA)
- LMR®-LLPL Plenum Rated Coax (UL/NEC 'CATVP', CSA)
- nu-TRAC® Radiating Cable
- Nu-RAD Radiating Cable
- EZ Install (non-solder) Connectors
- Hardware Accessories

 **TIMES** MICROWAVE SYSTEMS
A Smiths Group plc company

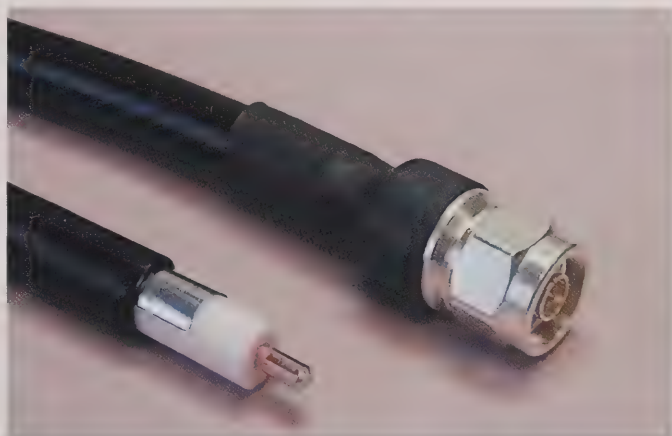


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www.timesmicrowave.com

Radiating cable overview/ introduction

Times offers a range of radiating cables which are used to provide radio frequency coverage in enclosed areas where single point source antennas are not practical. These cables, also referred to as leaky coax, are installed in a wide range of applications to provide coverage solutions. Such applications include underground metro stations, tunnels, mines, ships and in-building wireless systems. The cables are designed to provide uniform RF coverage where needed. These cables may be used as a single backbone to provide multiple services across a broad frequency range from AM radio rebroadcast through the higher frequency 802.11 WLAN applications.

T-RAD leaky feeder cables offer a cost effective solution to provide RF coverage in enclosed areas. The flexibility of the cable combined with quick attachment connectors, allows the cable to be easily installed, which is ideal for in-building applications. Reference pages 152-164 for additional information regarding the T-RAD line of leaky feeder cables.



nuTRAC cables are designed to provide continuous radio coverage in long tunnel runs. The coupled energy between the inner and outer bonded semi-circular shields, allows the cable to be directly mounted to tunnel walls with no degradation in electrical performance. This added benefit eliminates the need for standoffs thus reducing the overall installation costs. Reference pages 165-171 for additional information on the range of nuTRAC products.



TIMES MICROWAVE SYSTEMS

A Smiths Group plc company

T-RAD-400

50 Ohm Leaky Feeder Coaxial Cable

- Provides RF coverage in buildings, mines and other enclosed areas
- Offers broadband performance up to 2.5 GHz
- Flexible, non-kinking design provides easier installation
- Optional low-smoke, non-halogen construction available
- Accepts standard "EZ" crimp connectors used for LMR-400 cable*



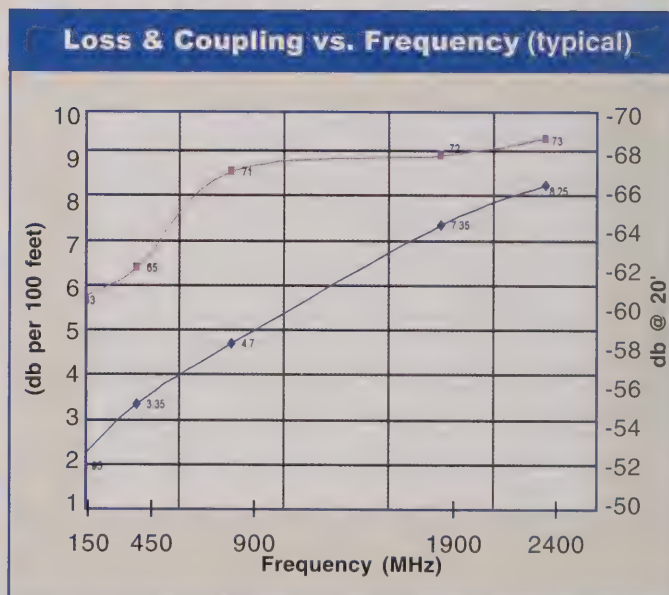
Part Description				
Part No.	Application	Jacket	Color	Stock Code
AA-9300	T-RAD-400-PVC	PVC	Black	44043
AA-9093	T-RAD-400-FR	FRPE	Black	44027

Construction Specifications			
Description	Material	In.	(mm)
Inner Conductor	Solid BCCAl	0.108	(2.74)
Dielectric	Gas-Injected Foam Polyethylene	0.285	(7.24)
Inner Shield	Bonded Aluminum Tape	0.291	(7.39)
Jacket	(per table above)	0.405	(10.29)

Mechanical Specifications			
Performance Property	Units	US	(metric)
Bend Radius: installation	in. (mm)	1.0	(25.4)
Bend Radius: repeated	in. (mm)	4.0	(101.6)
Weight	lb/ft (kg/m)	0.04	(0.137)

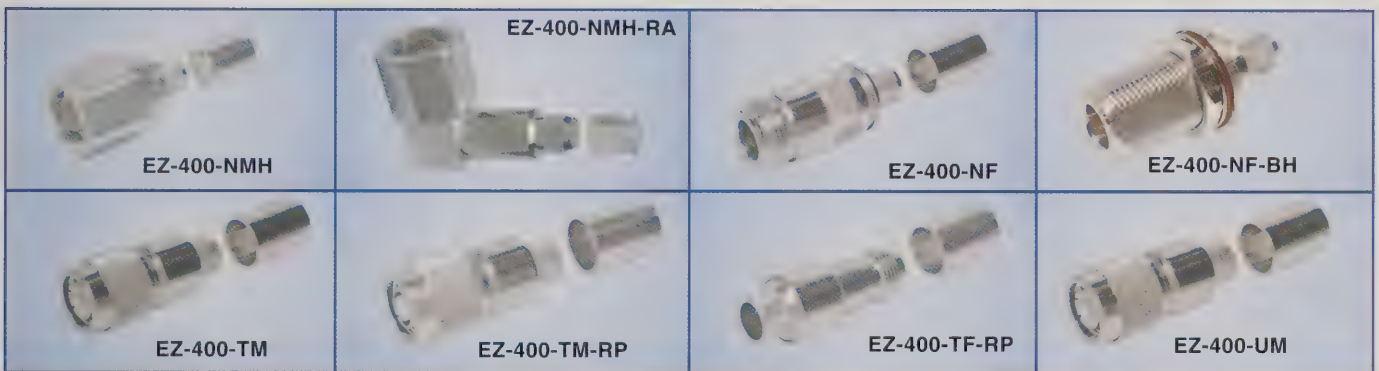
Environmental Specifications			
Performance Property	°F	°C	
Operating Temperature Range	-40/+185	-40/+85	

Electrical Specifications			
Performance Property	Units	US	(metric)
Velocity of Propagation	%		86
Dielectric Constant	NA		1.35
Time Delay	nS/ft (nS/m)	1.18	(3.87)
Impedance	ohms		50
Voltage Withstand	Volts DC		2500
Jacket Spark	Volts RMS		6000



Frequency (MHz)	150	450	900	1900	2400
Attenuation dB/100 ft	1.95	3.35	4.70	7.35	8.25
Attenuation dB/100 m	6.4	10.9	15.4	24.1	29.0
Coupling Loss** dB	63	65	71	72	73

* Request T-RAD-400 connector data sheet and attachment instructions
 ** Coupling loss measured at 6.5 feet (2 meters) *** Patent applied for



Connectors

Interface	Description	Part Number	Stock Code	VSWR** Freq. (GHz)	Coupling Nut	Inner Contact Attach	Outer Contact Attach	Finish* Body /Pin	Length in (mm)	Width in (mm)	Weight lb (g)
N Male	Straight Plug	EZ-400-NMH	3190-400	<125:1 (25)	Hex	Spring Finger	Crimp	SG	1.5 (38)	0.89 (22.6)	0.113 (51.3)
	Right Angle	EZ-400-NMH-RA	3190-761	<1.35:1 (25)	Hex	Spring Finger	Crimp	SG	1.8 (46)	1.25 (31.8)	0.130 (59.0)
N Female	Straight Jack	EZ-400-NF	3190-956	<125:1 (25)	NA	Spring Finger	Crimp	NG	1.8 (46)	0.66 (16.8)	0.105 (47.6)
	Bulkhead Jack	EZ-400-NF-BH	3190-518	<125:1 (25)	NA	Spring Finger	Crimp	NG	1.8 (46)	0.88 (22.4)	0.102 (46.3)
TNC Male	Straight Plug	EZ-400-TM	3190-650	<125:1 (25)	Knurl	Spring Finger	Crimp	NS	1.7 (43)	0.59 (15.0)	0.074 (33.6)
	Reverse Polarity	EZ-400-TM-RP	3190-794	<125:1 (25)	Knurl	Spring Finger	Crimp	AG	1.7 (43)	0.59 (15.0)	0.074 (33.6)
TNC Female	Reverse Polarity	EZ-400-TF-RP	3190-795	<125:1 (25)	NA	Spring Finger	Crimp	AG	1.8 (46)	0.55 (14.0)	0.074 (33.6)
UHF Male	Straight Plug	EZ-400-UM	3190-997	<125:1 (25)	Knurl	Spring Finger	Crimp	NG	1.9 (48)	0.80 (20.3)	0.080 (40.8)

* Finish metals: N=Nickel, S=Silver, G=Gold, SS=Stainless Steel, A=Alballoy **VSWR spec based on 3 foot cable with a connector pair

TIMES MICROWAVE SYSTEMS

A Smiths Group plc company

T-RAD-400-LLPL 50 Ohm Leaky Feeder Coaxial Cable

- Provides RF coverage in buildings, mines and other enclosed areas
- Offers broadband performance up to 2.5 GHz
- Flexible, non-kinking design provides easier installation
- UL/NEC Plenum Rated "CMP/MPP" (CSA FT-6)
- Accepts standard "EZ" crimp connectors used for LMR-400-LLPL cable*



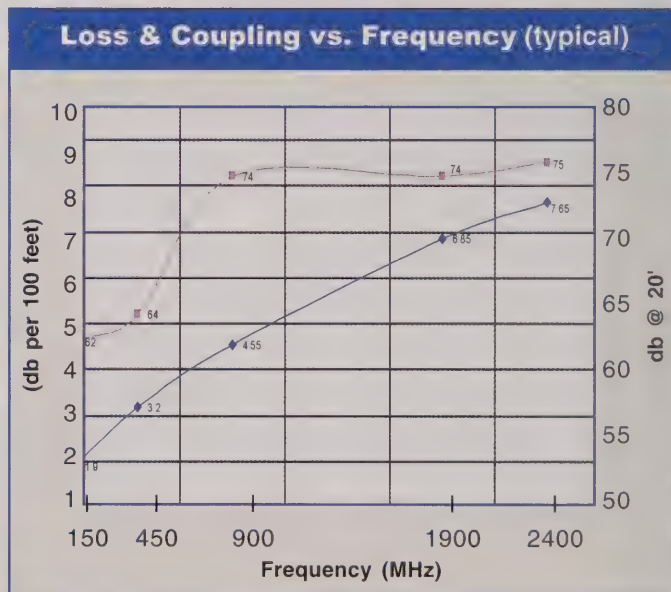
Part Description				
Part No.	Application	Jacket	Color	Stock Code
AA-9296	T-RAD-400-LLPL	FRPVC	Orange	44040

Construction Specifications				
Description	Material	In.	(mm)	
Inner Conductor	Solid BCCAI	0.095	(2.41)	
Dielectric	Low Density PTFE	0.285	(7.24)	
Inner Shield	Bonded Aluminum Tape	0.291	(7.39)	
Jacket	Extruded FRPVC	0.405	(10.29)	

Mechanical Specifications				
Performance Property	Units	US	(metric)	
Bend Radius: installation	in. (mm)	1.0	(25.4)	
Bend Radius: repeated	in. (mm)	4.0	(101.6)	
Weight	lb/ft (kg/m)	0.09	(0.137)	

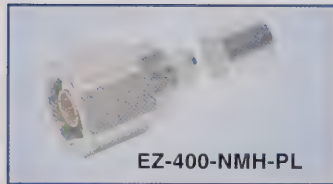
Environmental Specifications				
Performance Property		°F	°C	
Operating Temperature Range		-23/+167	-5/+75	

Electrical Specifications				
Performance Property	Units	US	(metric)	
Velocity of Propagation	%		76	
Dielectric Constant	NA		1.73	
Time Delay	nS/ft (nS/m)	1.34	(4.40)	
Impedance	ohms		50	
Voltage Withstand	Volts DC		2500	
Jacket Spark	Volts RMS		8000	



Frequency (MHz)	150	450	900	1900	2400
Attenuation dB/100 ft	1.9	3.2	4.55	6.85	7.65
Attenuation dB/100 m	6.2	10.5	14.9	22.5	25.1
Coupling Loss** dB	62	64	74	74	75

* Request T-RAD-400 connector data sheet and attachment instructions
 ** Coupling loss measured at 6.5 feet (2 meters) *** Patent applied for



EZ-400-NMH-PL

Connectors

Interface	Description	Part Number	Stock Code	VSWR** Freq. (GHz)	Coupling Nut	Inner Contact Attach	Outer Contact Attach	Finish* Body /Pin	Length in (mm)	Width in (mm)	Weight lb (g)
NMale	Straight Plug	EZ-400-NMH-PL	3190-602	<1.25:1 (2.5)	Hex	Spring Finger	Crimp	S/G	1.5 (38)	0.89 (22.6)	? ?

* Finish metals: N=Nickel, S=Silver, G=Gold, SS=Stainless Steel, A=Alballoy **VSWR spec based on 3 foot cable with a connector pair

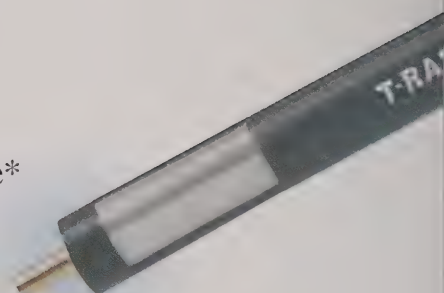
TIMES MICROWAVE SYSTEMS

A Smiths Group plc company

T-RAD-600

50 Ohm Leaky Feeder Coaxial Cable

- Provides RF coverage in buildings, mines and other enclosed areas
- Offers broadband performance up to 2.5 GHz
- Flexible, non-kinking design provides easier installation
- Accepts standard "EZ" crimp connectors used for LMR-600 cable*



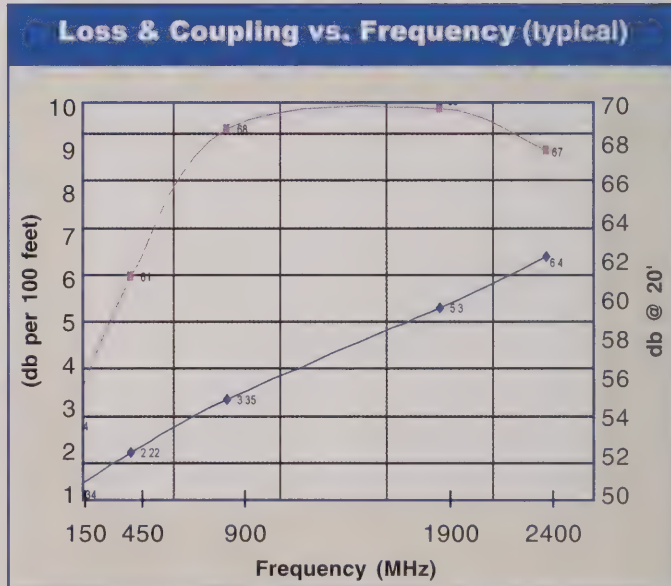
Part Description				
Part No.	Application	Jacket	Color	Stock Code
AA 9096	T-RAD-600-PVC	PVC	Black	44030
AA-9097	T-RAD-600-FR	FRPE	Black	44031

Construction Specifications			
Description	Material	In.	(mm)
Inner Conductor	Solid BCCAI	0.176	(4.47)
Dielectric	Gas-Injected Foam Polyethylene	0.455	(11.56)
Inner Shield	Bonded Aluminum Tape	0.458	(11.63)
Jacket	Extruded PVC	0.530	(13.46)

Mechanical Specifications			
Performance Property	Units	US	(metric)
Bend Radius: installation	in. (mm)	1.5	(38)
Bend Radius: repeated	in. (mm)	6.0	(152.4)
Weight	lb/ft (kg/m)	0.09	(0.137)

Environmental Specifications			
Performance Property	°F	°C	
Operating Temperature Range	-40/+185	-40/+85	

Electrical Specifications			
Performance Property	Units	US	(metric)
Velocity of Propagation	%	86	
Dielectric Constant	NA	1.35	
Time Delay	nS/ft (nS/m)	1.18	(3.87)
Impedance	ohms	50	
Voltage Withstand	Volts DC	4000	
Jacket Spark	Volts RMS	6000	



Frequency (MHz)	150	450	900	1900	2400
Attenuation dB/100 ft	1.34	2.22	3.35	5.30	6.40
Attenuation dB/100 m	4.39	7.28	10.98	17.38	20.99
Coupling Loss** dB	54	61	68	69	67

* Request T-RAD-600 connector data sheet and attachment instructions

** Coupling loss measured at 6.5 feet (2 meters) *** Patent applied for



Connectors

Interface	Description	Part Number	Stock Code	VSWR** Freq. (GHz)	Coupling Nut	Inner Contact Attach	Outer Contact Attach	Finish* Body /Pin	Length in (mm)	Width in (mm)	Weight lb (g)
N Male	Straight Plug	EZ-600-NMH-B	3190-1268	<1.25:1 (25)	Hex	Spring Finger	Crimp	SG	21 (53)	0.92 (23.4)	1.164 (74.4)
	Right Angle	EZ-600-NMH-RA	3190-762	<1.35:1 (9)	Hex	Spring Finger	Crimp	SG	21 (53)	0.92 (23.4)	0.185 (83.9)
N Female	Straight Jack	EZ-600-NF	3190-955	<1.25:1 (25)	NA	Spring Finger	Crimp	SG	23 (59)	0.87 (22.1)	0.150 (68.0)
	Bulkhead Jack	EZ-600-NF-BH	3190-616	<1.25:1 (25)	NA	Spring Finger	Crimp	SG	24 (61)	0.88 (22.4)	0.195 (88.5)
TNC Male	Straight Plug	EZ-600-TM	3190-418	<1.25:1 (25)	Knurl	Spring Finger	Crimp	SG	17 (43)	0.59 (15.0)	0.112 (50.8)
	Reverse Polarity	EZ-600-TM-RP	3190-796	<1.25:1 (25)	Knurl	Spring Finger	Crimp	AG	22 (56)	0.87 (22.0)	0.112 (50.8)
TNC Female	Reverse Polarity	EZ-600-TF-RP	3190-797	<1.25:1 (25)	NA	Spring Finger	Crimp	AG	23 (58)	0.87 (22.0)	0.100 (45.4)
UHF Male	Straight Plug	EZ-600-UM	3190-615	<1.25:1 (25)	Knurl	Spring Finger	Crimp	SG	17 (43)	0.88 (22.4)	0.164 (74.4)
7-16 DIN Male	Straight Plug	EZ-600-716MH	3190-503	<1.25:1 (25)	Hex	Spring Finger	Crimp	SS	20 (51)	1.30 (33.0)	0.254 (115.2)

* Finish metals: N=Nickel, S=Silver, G=Gold, SS=Stainless Steel, A=Alballoy **VSWR spec based on 3 foot cable with a connector pair

TIMES MICROWAVE SYSTEMS

A Smiths Group plc company

T-RAD-600-DB

50 Ohm Leaky Feeder Coaxial Cable

- Provides RF coverage in buildings, mines and other enclosed areas
- Watertight design for direct bury applications
- Offers broadband performance up to 2.5 GHz
- Flexible, non-kinking design provides easier installation
- Accepts standard "EZ" crimp connectors used for LMR-600 cable*



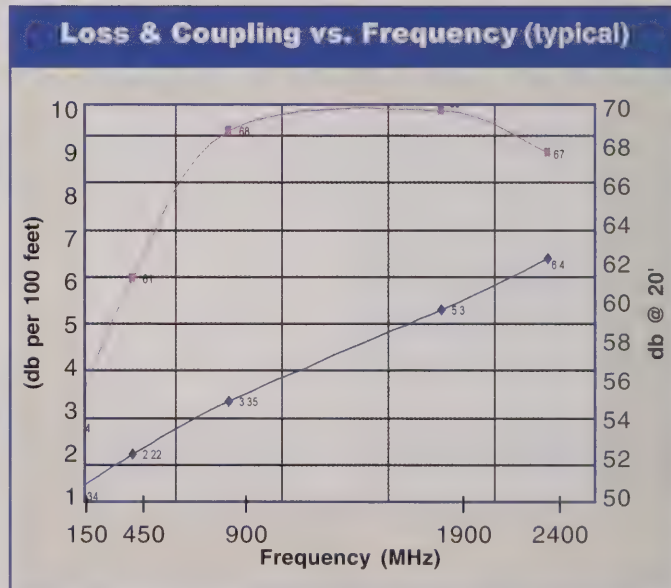
Part Description				
Part No.	Application	Jacket	Color	Stock Code
AA-9299	T-RAD-600-DB	PVC/PE	Black	44038

Construction Specifications				
Description	Material	In.	(mm)	
Inner Conductor	Solid BCCAI	0.176	(4.47)	
Dielectric	Gas-Injected Foam Polyethylene	0.455	(11.56)	
Inner Shield	Bonded Aluminum Tape	0.458	(11.63)	
Jacket	Extruded PVC/PE	0.590	(14.98)	

Mechanical Specifications				
Performance Property	Units	US	(metric)	
Bend Radius: installation	in. (mm)	1.5	(38)	
Bend Radius: repeated	in. (mm)	0.12	(.178)	
Weight	lb/ft (kg/m)	0.09	(0.137)	

Environmental Specifications				
Performance Property		°F	°C	
Operating Temperature Range		+23/+167	-5/+75	

Electrical Specifications				
Performance Property	Units	US	(metric)	
Velocity of Propagation	%		86	
Dielectric Constant	NA		1.35	
Time Delay	nS/ft (nS/m)	1.18	(3.87)	
Impedance	ohms		50	
Voltage Withstand	Volts DC		4000	
Jacket Spark	Volts RMS		6000	



Frequency (MHz)	150	450	900	1900	2400
Attenuation dB/100 ft	1.34	2.22	3.35	5.30	6.40
Attenuation dB/100 m	4.39	7.28	10.98	17.38	20.99
Coupling Loss** dB	54	61	68	69	67

* Request T-RAD-600 connector data sheet and attachment instructions

** Coupling loss measured at 6.5 feet (2 meters) *** Patent applied for



Connectors

Interface	Description	Part Number	Stock Code	VSWR** Freq. (GHz)	Coupling Nut	Inner Contact Attach	Outer Contact Attach	Finish* Body /Pin	Length in (mm)	Width in (mm)	Weight lb (g)
N Male	Straight Plug	EZ-600-NMH-B	3190-1268	<1.25:1 (25)	Hex	Spring Finger	Crimp	SG	21 (53)	0.92 (23.4)	1.164 (74.4)
	Right Angle	EZ-600-NMH-RA	3190-762	<1.35:1 (6)	Hex	Spring Finger	Crimp	SG	21 (53)	0.92 (23.4)	0.185 (83.9)
N Female	Straight Jack	EZ-600-NF	3190-955	<1.25:1 (25)	NA	Spring Finger	Crimp	SG	23 (59)	0.87 (22.1)	0.150 (68.0)
	Bulkhead Jack	EZ-600-NF-BH	3190-616	<1.25:1 (25)	NA	Spring Finger	Crimp	SG	24 (61)	0.88 (22.4)	0.195 (88.5)
TNC Male	Straight Plug	EZ-600-TM	3190-418	<1.25:1 (25)	Knurl	Spring Finger	Crimp	SG	1.7 (43)	0.59 (15.0)	0.112 (50.8)
	Reverse Polarity	EZ-600-TM-RP	3190-796	<1.25:1 (25)	Knurl	Spring Finger	Crimp	AG	22 (56)	0.87 (22.0)	0.112 (50.8)
TNC Female	Reverse Polarity	EZ-600-TF-RP	3190-797	<1.25:1 (25)	NA	Spring Finger	Crimp	AG	2.3 (58)	0.87 (22.0)	0.100 (45.4)
UHF Male	Straight Plug	EZ-600-UM	3190-615	<1.25:1 (25)	Knurl	Spring Finger	Crimp	SG	1.7 (43)	0.88 (22.4)	0.164 (74.4)
7-16 DIN Male	Straight Plug	EZ-600-716MH	3190-503	<1.25:1 (25)	Hex	Spring Finger	Crimp	SS	20 (51)	1.30 (33.0)	0.254 (115.2)

* Finish metals: N=Nickel, S=Silver, G=Gold, SS=Stainless Steel, A=Alballoy **VSWR spec based on 3 foot cable with a connector pair

TIMES MICROWAVE SYSTEMS

A Smiths Group plc company

T-RAD-600-LLPL 50 Ohm Leaky Feeder Coaxial Cable

- Provides RF coverage in buildings, mines and other enclosed areas
- Offers broadband performance up to 2.5 GHz
- Flexible, non-kinking design provides easier installation
- UL/NEC Plenum rated "CMP/MPP" (CSA FT-6)
- Accepts standard "EZ" crimp connectors used for LMR-600-LLPL cable*



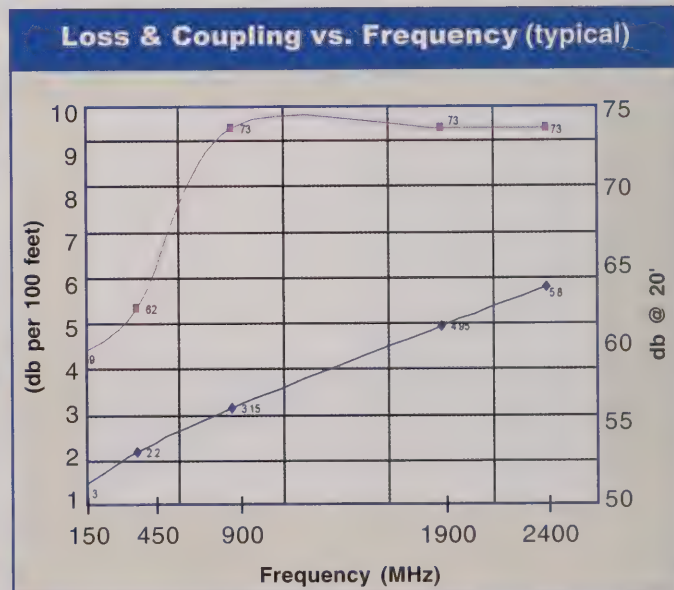
Part Description				
Part No.	Application	Jacket	Color	Stock Code
AA 9297	T-RAD-600-LLPL	FRPVC	Orange	44041

Construction Specifications			
Description	Material	In.	(mm)
Inner Conductor	Solid BCCAI	0.150	(3.81)
Dielectric	Low Density PTFE	0.455	(11.56)
Inner Shield	Bonded Aluminum Tape	0.461	(11.71)
Jacket	Extruded FRPVC	0.530	(13.46)

Mechanical Specifications			
Performance Property	Units	US	(metric)
Bend Radius: installation	in. (mm)	1.5	(38)
Bend Radius: repeated	in. (mm)	6.0	(152.4)
Weight	lb/ft (kg/m)	0.18	(0.27)

Environmental Specifications			
Performance Property		°F	°C
Operating Temperature Range		+23/+167	-5/+75

Electrical Specifications			
Performance Property	Units	US	(metric)
Velocity of Propagation	%		76
Dielectric Constant	NA		1.73
Time Delay	nS/ft (nS/m)	1.34	(4.40)
Impedance	ohms		50
Voltage Withstand	Volts DC		4000
Jacket Spark	Volts RMS		6000



Frequency (MHz)	150	450	900	1900	2400
Attenuation dB/100 ft	1.3	2.2	3.5	4.95	5.8
Attenuation dB/100 m	4.26	7.22	10.3	16.27	19.0
Coupling Loss** dB	59	62	73	73	73

* Request T-RAD-600 connector data sheet and attachment instructions
 ** Coupling loss measured at 6.5 feet (2 meters) *** Patent applied for



Connectors

Interface	Description	Part Number	Stock Code	VSWR Freq. (GHz)	Coupling Nut	Inner Contact Attach	Outer Contact Attach	Finish* Body /Pin	Length in (mm)	Width in (mm)	Weight lb (g)
N Male	Straight Plug	EZ-600-NMH-PL	3190-603	<1.25:1 (2.5)	Hex	Spring Finger	Crimp	S/G	2.1 (53)	0.92 (23.4)	0.166 (75.3)
	Straight Plug	TC-600-NMH-PL	3190-760	<1.25:1 (2.5)	Hex	Solder	Crimp	S/G	2.1 (5.3)	0.92 (23.4)	0.208 (93.4)
	Right Angle	TC-600-NMH-RA	3190-785	<1.35:1 (2.5)	Hex	Solder	Crimp	S/G	2.1 (53)	0.92 (23.4)	0.185 (83.9)

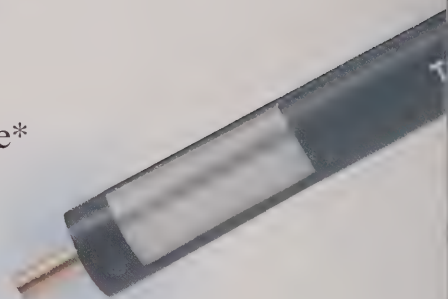
* Finish metals: N=Nickel, S=Silver, G=Gold, SS=Stainless Steel, A=Alballoy **VSWR spec based on 3 foot cable with a connector pair

TIMES MICROWAVE SYSTEMS

A Smiths Group plc company

T-RAD-900**50 Ohm Leaky Feeder Coaxial Cable**

- Provides RF coverage in buildings, mines and other enclosed areas
- Offers broadband performance up to 2.5 GHz
- Flexible, non-kinking design provides easier installation
- Accepts standard "EZ" clamp connectors used for LMR-900 cable*



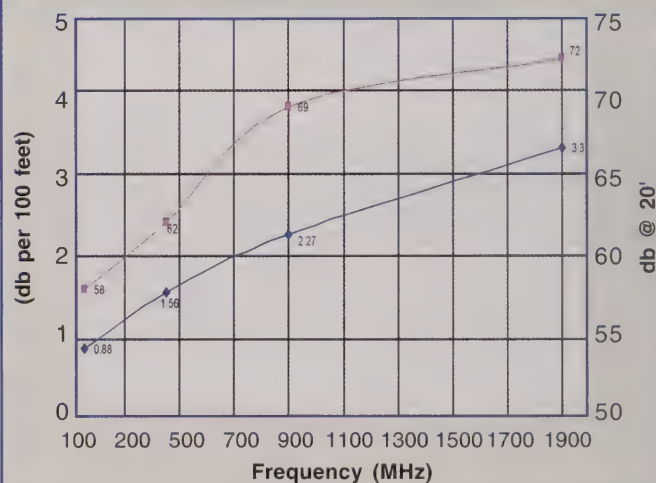
Part Description				
Part No.	Application	Jacket	Color	Stock Code
AA-9298	T-RAD-900-PVC	PVC	Black	44042

Construction Specifications			
Description	Material	In.	(mm)
Inner Conductor	BC Tube	0.262	(6.65)
Dielectric	Gas-Injected Foam Polyethylene	0.680	(17.27)
Inner Shield	Bonded Aluminum Tape	0.686	(17.42)
Jacket	Extruded PVC	0.870	(22.10)

Mechanical Specifications			
Performance Property	Units	US	(metric)
Bend Radius: installation	in. (mm)	3.00	(76.2)
Bend Radius: repeated	in. (mm)	9.0	(228.6)
Weight	lb/ft (kg/m)	0.266	(0.40)

Environmental Specifications			
Performance Property		°F	°C
Operating Temperature Range		-40/+185	-40/+85

Electrical Specifications			
Performance Property	Units	US	(metric)
Velocity of Propagation	%	87	
Dielectric Constant	NA	1.32	
Time Delay	nS/ft (nS/m)	1.17	(3.83)
Impedance	ohms	50	
Voltage Withstand	Volts DC	5000	
Jacket Spark	Volts RMS	8000	

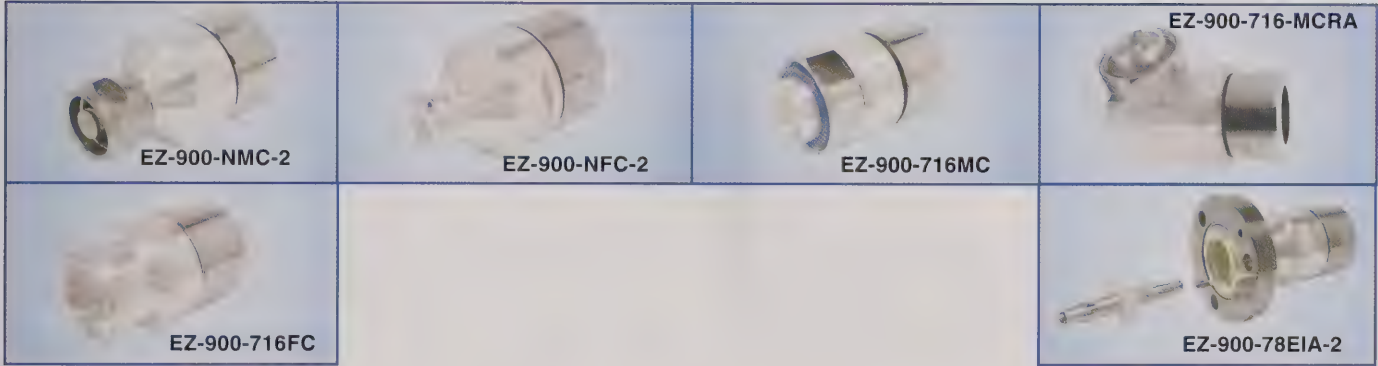
Loss & Coupling vs. Frequency (typical)

Frequency (MHz)	150	450	900	1900
Attenuation dB/100 ft	0.88	1.56	2.27	3.3
Attenuation dB/100 m	2.89	5.12	7.44	10.8
Coupling Loss** dB	58	62	69	72

* Request T-RAD-900 connector data sheet and attachment instructions

** Coupling loss measured at 6.5 feet (2 meters) *** Patent applied for

PVC TIMES MICROWAVE



Connectors

Interface	Description	Part Number	Stock Code	VSWR** Freq. (GHz)	Coupling Nut	Inner Contact Attach	Outer Contact Attach	Finish* Body /Pin	Length in (mm)	Width in (mm)	Weight lb (g)
N Male	Straight Plug	EZ-900-NMC-2	3190-1262	<1.25:1 (6)	Hex	Press Fit	Clamp	S/S	2.0 (51)	1.38 (35.1)	0.463 (210.0)
N Female	Straight Jack	EZ-900-NFC-2	3190-1263	<1.25:1 (6)	NA	Press Fit	Clamp	SS	20 (51)	1.38 (35.1)	0.443 (200.9)
7-16 DIN Male	Straight Plug	EZ-900-716MC	3190-333	<1.25:1 (25)	Hex	Press Fit	Clamp	SS	20 (51)	1.44 (36.6)	0.485 (220.0)
7-16 DIN Male	Right Angle	EZ-900-716MCRA	3190-614	<1.35:1 (25)	Hex	Press Fit	Clamp	SS	27 (69)	2.15 (55.0)	1.150 (521.6)
7-16 DIN Female	Straight Jack	EZ-900-716FC	3190-334	<1.25:1 (25)	NA	Press Fit	Clamp	SS	20 (51)	1.38 (35.1)	0.379 (171.9)
78 EIA	Straight Plug	EZ-900-78EIA-2	3190-1282	<1.25:1 (25)	NA	Press Fit	Clamp	SS	30 (76)	2.24 (56.9)	1.013 (459.5)

* Finish metals: N=Nickel, S=Silver, G=Gold, SS=Stainless Steel, A=Alballoy **VSWR spec based on 3 foot cable with a connector pair

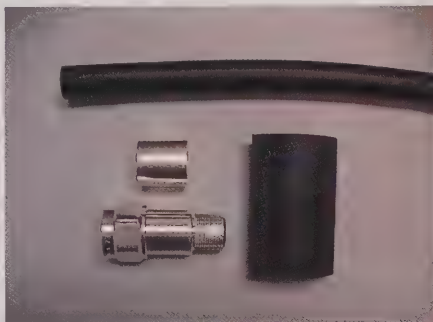
TIMES MICROWAVE SYSTEMS

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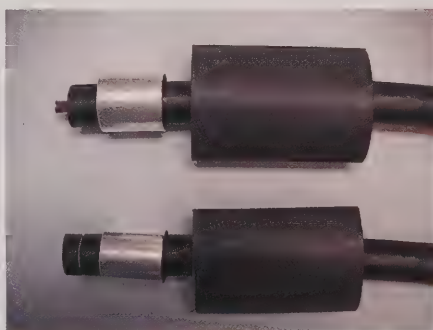
T-RAD Connector installation procedure

T-RAD cable accepts standard EZ style (non-solder) crimp connectors. Reference the appropriate cable size for available types

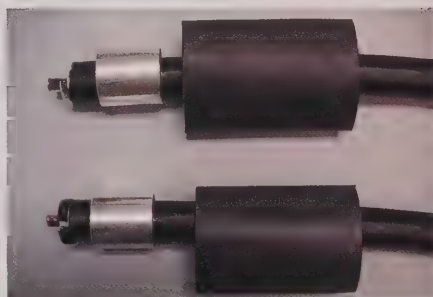
Step 1: Flush out the cable squarely



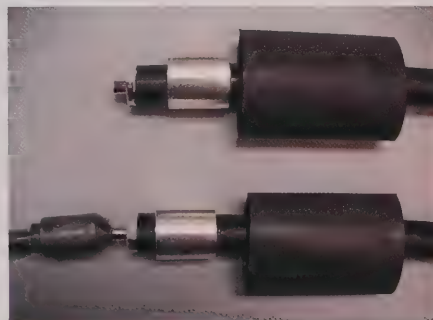
Step 2: Slide the heat shrink and ferule over the cable. Use a knife or razor to cut a 0.250" long ring from the end of the cable. Make sure that the cut is square.



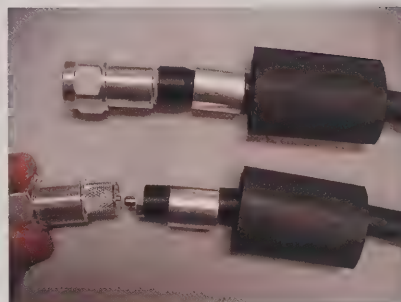
Step 3: Lightly score the circumference of the cable 0.20" back from the end of the core. Make one long longitudinal cut. Pry up a piece of the jacket and gently peel the ring of the jacket off the core.



Step 4: Debur the center conductor using the DBT 01 deburring tool



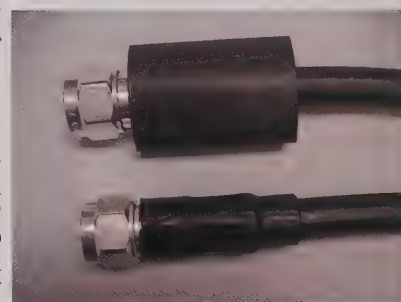
Step 5: Slide the connector over the end of the core and push it up to the end of the jacket. Rotate the connection back and forth in a clockwise-counter clockwise motion in reference to the axis of the cable until the back of the connector works its way under the end of the jacket. Now push the connector onto the cable with some back and forth motion until it stops.



Step 6: Position the heavy duty HX-4 crimp tool, with the appropriate dies, directly behind and adjacent to the connector body, and crimp the connector. The crimp tool automatically releases when the crimp is complete.



Step 7: Position the heat shrink boot as far forward on the connector body as possible without interfering with the coupling nut; use a heat gun to form a weather-tight seal.



nuTRAC Triaxial Antenna Cable

INTRODUCTION

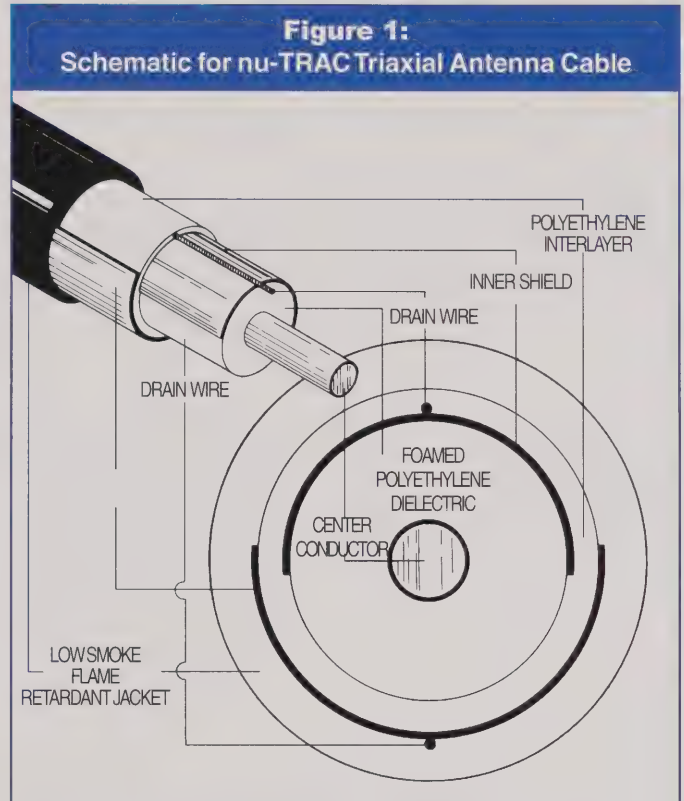
Times nu-TRAC Triaxial Antenna Cable functions as a continuous antenna to provide controlled RF coverage. These cables are especially useful in achieving coverage in otherwise shielded areas, which cannot be reached effectively with point source antennas.

The patented triaxial design lends itself to tight dimensional tolerances which result in consistent and predictable performance. When compared to conventional slotted corrugated copper designs, the triaxial nu-TRAC cable exhibits electrical performance which is not affected by the surrounding environment nor the method in which the cable is mounted.

APPLICATIONS

Obtaining proper radio frequency coverage in areas where RF signals do not readily propagate via antennas, has posed a challenge to communication systems designers. The use of radiating cables provides an increase in the coverage of communication systems in structures which inhibit RF propagation. Examples of areas which are difficult to achieve coverage with point source antennas include transit system tunnels, mines, metal hulled ships, nuclear power plants and buildings with metal supporting structures.

Radiating cables are also used instead of point source antennas because they emit very low power levels, which reduces the potential for interference with other nearby systems using the same frequencies and allows for frequency reuse. This frequency reuse is becoming increasingly important as the available RF spectrum is shrinking due to the growth in wireless systems continues to increase. Examples are the creation of mini-cells within a building and low level



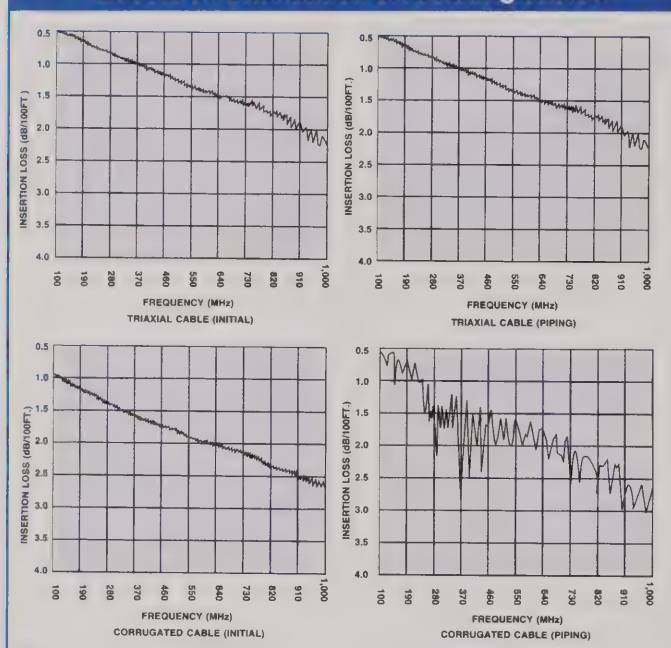
roadside AM broadcast systems.

Radiating cables can be used over a wide frequency range, and have been used to extend coverage for many types of systems including cellular, PCN/PCS, paging, two way radio, broadcast radio/TV, and data. An important trend is the development of Wireless Local Area Networks or LAN's. By using radio frequency waves to connect computers and telephones within an office environment, the cost and time to run new cables to accommodate the growth and changes is greatly reduced.

Other innovative uses for radiating cables include hospital patient monitoring systems which allows patients freedom of movement, automatic highway toll recording systems and shipboard/offshore below deck communication systems. The nu-TRAC radiating cable's capabilities allows the system design engineer to create inno-

nuTRAC Triaxial Antenna Cable

Figure 2:
Effects on attenuation of radiating cables



vative solutions to many RF coverage problems.

Times has supplied many miles of radiating cables of various sizes, to offer the system designer a solution to their radio frequency coverage problems. From installations within the New York Subway System, London Underground and the Beijing Transit System, to providing radio frequency coverage in Nuclear Power Plants and in-building applications for cellular and PCS applications, Times can offer a radiating cable product to meet these tough requirements.

DESIGN CHARACTERISTICS

As with all RF transmission lines, the most important function is to transmit RF energy from one point in a system to another with minimal loss of signal power. The difference between radiating transmission lines and conventional shielded coaxial cables is that this design must also allow a controlled amount of RF energy to couple out of the cable and into the surrounding

environment, without sacrificing too much in downline signal attenuation.

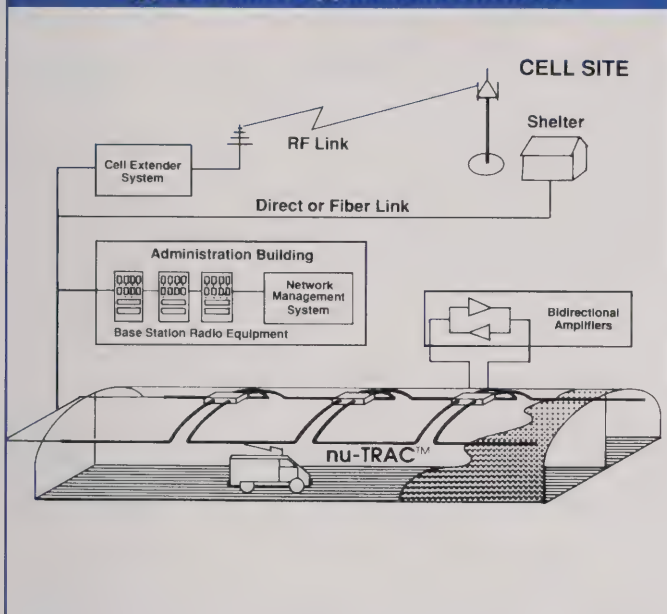
Figure one shows the basic construction of the triaxial radiating cable design. Depending on the cable size, either a copper-clad aluminum conductor or a hollow copper tube is used for the center conductor. The dielectric material utilizes a high velocity, closed cell foamed polyethylene which offers a low loss medium for the transfer of RF energy between the center and outer conductors. The outer shields consist of a bonded semicircular aluminum tape, which is separated by a layer of low loss polyethylene. Braided drain wires are used to provide contact with the two outer shields when connectors are attached.

There are a variety of material options available for the jacketing of the nu-TRAC cables. The most common jacket that is utilized is a low-smoke, non-halogen polyolefin. This type of jacketing system is required by many rapid transit systems, as well as various safety and building codes, to provide a safe low smoke generating material in the event of a fire. Polyethylene jackets are also used for applications such as travel advisory radio, where the cable is buried alongside a road and the need for flame retardance is not a concern.

ELECTRICAL CHARACTERISTICS

The two most important parameters of radiating cable are downline signal attenuation and coupling loss. The coupling performance is described as the difference between the signal level in the radiating cable and the signal received through a 0 dB gain antenna mounted twenty feet away. Although frequently only the median value is reported, this is not the best approach,

Figure 3:
Typical tunnel application schematic

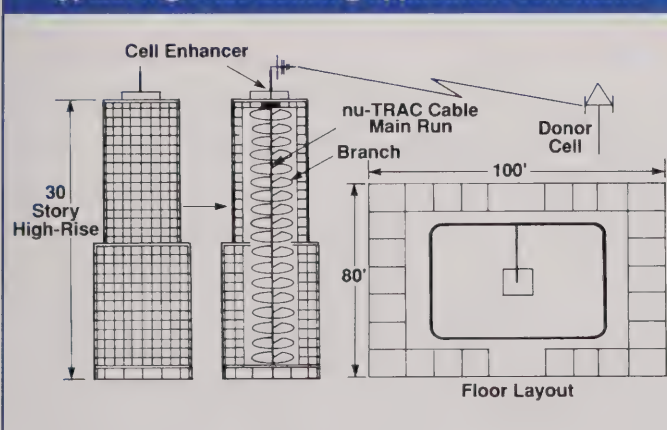


since communication systems are rarely designed for a 50% probability of successful communications. In order to accurately characterize the coupling performance of nu-TRAC cable, Times has developed an automated testing station that uses a synthesized source, a spectrum analyzer, and a motorized cart with a half wave dipole antenna. The system has been programmed to test 1200 data points along a 100

foot track which is located 20 feet from the cable under test. The cable is mounted directly to concrete with standard metallic cable clamps. The data is fed directly into a computer which calculates the median coupling loss values. The receiving antenna is horizontally polarized for the data included in this catalog. Tests have determined that the vertical polarized signal is of a comparable level, due to the multipath effects and surrounding environments reflections. The measured coupling loss data is sorted and graphed to provide a valuable tool- the Probability of Communication Graph. Its use is further explained in the Systems Design section.

The coupling loss and attenuation are controlled by the separation of the split shields in the nu-TRAC design, which results in the transfer of a small amount of energy between the separated shields. This approach optimizes the trade-off between attenuation and coupling loss while transferring energy in a manner that results in little sensitivity to the environment and mounting conditions. The electrical values of the standard nu-TRAC cables are provided. The values that are referenced are typical of installed conditions and will not change due to the environment or mounting conditions.

Figure 4:
Typical high rise building application schematic



In Figure two it can be seen that the nu-TRAC design exhibits little sensitivity to the surrounding environment. The effects of a section of steel piping on the attenuation performance of both slotted corrugated copper, and the nu-TRAC triaxial design are compared. Both constructions exhibit similar initial attenuation values through 1000 megahertz, but with the introduction of a section of steel piping, the triaxial design is virtually unaffected, whereas the slotted copper

nuTRAC Triaxial Antenna Cable

Table 1:

Physical and mechanical requirements

Test requirements	Test method	Specification requirements
Physical requirements unaged	ASTM D 412-87	
Tensile str. (min. PSI)		1000 PSI
Elongation (min.%)		100%
Aging requirements after air oven for 168 hours @100°C	ICEA 5-68-516	
Tensile str. (min % of unaged)		60%
Elongation (min. % of original)		60%
Oil immersion requirements at ASTM #2 oil for 4 hours at 70°C	ASTM D 471-79	
Tensile str. (min % of unaged)		60%
Elongation (min. % of original)		60%
Durometer shore A	ASTM D 2240-86	80 minimum
Cold bend (@ -25°C)	ICEA S-19-81 6th ed., Sept. 19, part 6	Pass
Water absorption, gravimetric method, 168 hours @70°C (mg/sq. in. max.)	ASTM D 470-82	35 max
Ozone resistance test	ASTM D 470-82	Pass
Tear resistance test (min) lbs/in	ASTM D 624-86	25
	ASTM D 470-82	25

design exhibits a significant deterioration in signal. With the ability to directly mount the nu-TRAC cables on a wall or next to a conductive surface, the result is the elimination of expensive standoffs, which provides a faster, lower cost installation that is more aesthetically pleasing.

OUTER JACKETING OPTIONS

Although Times can supply a wide variety of material options, the three standard jackets available for the range of nu-TRAC cables are;

Polyethylene (PE): Where flame retardancy is not a concern, the use of a rugged polyethylene material is utilized as the outer jacketing. Typical examples of these types of applications would be for direct burial applications, such as traffic advisory radio, or localized outdoor broadcast.

Table 2:

Flammability and combustion requirements

Test requirements	Test method	Specification requirements
Smoke index (max)	NES 711 issue	25
Toxicity (max)	NES 713 issue #1, 6/79	5
Acid gas equivalent (max %)	MIL-C-24643	0.5
(halogen content) (max %)	MIL-C-17	0.2
Limiting oxygen index (min)	ASTM D 2863-87	32
Smoke generation	ASTM E 662-83	
Flaming avg. DS 4 min. (max)		75
Flaming avg. DM (max)		300
Non-flaming avg. DS 4 min. (max)		75
Non-flaming avg. DM (max)		350
Flammability	IEEE 383-74	Pass
a. General (70,000 BTU/hr)		

Low-Smoke Polyolefin (VW1): Where there is a need to replace polyvinylchloride materials or the use of non-halogen materials is required, Times offers the VW1 jacketing option. This material offers a lower level of flame retardancy when compared to the standard -FR construction, but will meet many of the non-halogen and low-smoke producing requirements that are specified.

Flame Retardant, Low-Smoke Polyolefin (FR): The standard -FR jacketing option was designed to offer the highest level of flame retardance in a non-halogenated construction. These materials have been approved by major transit systems around the world, and meet many of the required IEC (International Electrotechnical Commission) standards that are specified.

Table One lists some of the basic physical and mechanical specifications that the -FR cables are required to meet. In Table Two the flammability and products of combustion requirements are listed. These referenced requirements are determined by the appropriate testing method, and in many cases the actual results are well

within the specification limits. For actual test results, contact the Times Microwave Engineering Department.

The nu-TRAC-FR radiating cables as well as the LMR-FR jumper cables have also been qualified and approved for in-building applications by UL (Underwriters Laboratories) and CSA (Canadian Standards Association). Contact Times Microwave for qualification file reference numbers and additional information.

INSTALLATION

The nu-TRAC cable offers a light weight flexible design that will not kink when being installed or when bent around tight corners. The small bending radii and excellent crush resistance provide the basis for easy and efficient cable installations. This easy installation is also enhanced due to the ability of the nu-TRAC design to be directly mounted to walls and next to any conductive type surfaces, without the sacrifice of any performance. The orientation of the slot internal to the nu-TRAC cable cannot be fixed in any one plane due to the natural spiral created in the manufacturing process. Testing has shown that the slot orientation has no effect on the nu-TRAC cable performance, and therefore should not be a concern to the installer or system designer. Times offers a variety of cable installation accessories, as well as easy attachment connectors, which can be referenced at the end of this section.

SYSTEM DESIGN

The median coupling loss is the 50% probability of communication value. The basis for the design of a communication system is the probability of successful communications. For a radiating cable system this depends primarily on the percentage of desired coverage area which has a signal level which is greater or equal to the receiver sensitivity. A radiating

cable produces a distribution of signal level along its length that is a function of the cable construction, the environment that it is installed in and the power level of the signal in the cable. The probability of communications depend on how the signal level along the cable compares to the receiver sensitivity.

To use the probability of communications graphs, first subtract the sum of the passive component losses in the system from the transmitter power. This gives the power level in the cable. Subtracting the receiver sensitivity gives the system available power (SAP). Thus;

$$SAP = XMT - RCV - PSV$$

Where; SAP = System Available Power

XMT= Transmitter Power

RCV= Receiver Sensitivity

PSV= All Passive Component Losses except for coupling loss (splitters, insertion loss of feeder cable, insertion loss of radiating cable, body loss, etc.)

Typically an additional 6 dB signal loss will occur for a receiver carried at belt level, depending on orientation relative to the transmitting antenna. When the radio is raised to head level for talking, this additional loss will be eliminated. Therefore, an additional allowance should be added for calculating the talk out path to a portable, body mounted radio.

Once the system available power is known, the probability of successful communication can be found on the Probability Of Communication graph for the applicable cable and frequency. Because these graphs are based on data collected from our testing facility, which is a near worst case environment, they form a good basis for a conservative system design in other prac-

nuTRAC Triaxial Antenna Cable

tical environments.

This process should be repeated with different cables, until the smallest cable which provides acceptable coverage is determined.

If an appropriate size is not included in this brochure, please contact the Times Microwave Systems engineering group for availability of additional constructions.

EXAMPLE OF SYSTEM DESIGN CALCULATION

Using 1400 feet of nu-TRAC TRC-500FR and 150 feet of LMR-400FR feeder cable at 450 MHz;

Transmitter Power = 30 dBm (1 Watt)

Receiver Sensitivity = 1 uV (-107 dBm)

Power Splitter Loss = 2 Splitters x

3 dB/Splitter = 6 dB

Feeder Cable Loss = 150 feet x

2.7 dB/100 ft = 4.1 dB

Radiating Cable Loss = 1400 feet x

2 dB/100 ft = 28 dB

Other Loss = 6 dB Body Loss for belt mounted portable radio

Then:

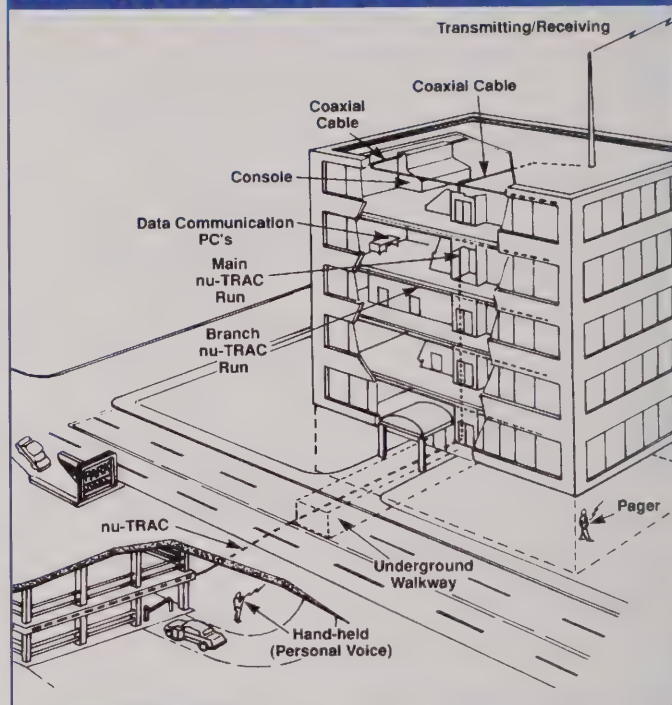
PSV = 6 + 4.1 + 28 + 6 = 44.1

SAP = XMT - PSV - RCV =

30 - 44.1 - (-107) = 92.9 dB

Reading off the 450 MHz Probability Of Communications graph for the nu-TRAC TRC-500FR cable, the system probability of communication is 93 %. If this is sufficient then this size cable can be used, otherwise repeat this process for larger size cables.

Figure 5:
Building specific coverage for voice and data



WORKSHEET

Power splitter loss _____ +

Feeder cable loss
length of cable dB/100 feet

_____ X _____ / 100' = _____ +

Radiating cable insertion loss
length of cable dB/100 feet

_____ X _____ / 100' = _____ +

Other loss _____ +

Total (passive system losses) PSV= _____

Transmitter power XMT= _____

Receiver power RCV= _____

SAP = XMT - RCV - PSV

_____ = _____ - _____ - _____

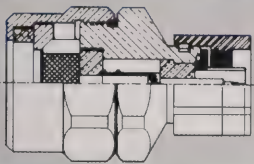
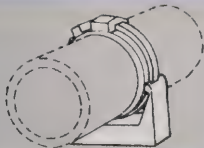


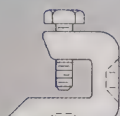




nuTRAC Accessories

Times offers a full line of accessories for radiating cables. nu-TRAC® cables can be directly mounted to a wall with standard inexpensive hardware and without the need for standoffs.

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nuTRAC

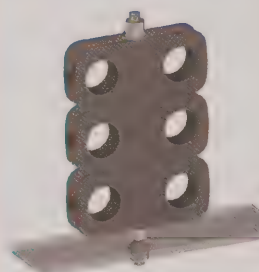
Type N connector	Description	TMS part no.	Cable size	Quant/ pkg.
	Designed to attach to TMS nu-TRAC® cables. Connector parts are iridited brass for long life. Contacts are gold plated. Available in female (NF) and male (NM).	TRB-500-NF	1/2"	1
		TRB-500-NM	1/2"	1
		TRB-875-NF	7/8"	1
		TRB-875-NM	7/8"	1
		TRB-1250-NF	1 1/4"	1
		TRB-1250-NM	1 1/4"	1
Auto lock hangers- nylon				
	Snap cables in... hangers lock it securely in place. Use with struts, threaded rods, wood, brick, concrete block, and beam clamps. Mount in any direction. Easy to install hangers made of corrosion resistant Nylon. Temp. range: -40° - +160°F.	TRA-01-500	1/2"	50
		TRA-01-875	7/8"	50
		TRA-01-1250	1 1/4"	20
Loop clamps				
	Cushioned clamps provide protection and routing support for cables. Extruded cushion makes uniform interior surface for good fit and consistent clamping force. Clamps are 1/2" wide and have a .265" mounting hole.	TRA-02-500	1/2"	100
		TRA-02-875	7/8"	100
		TRA-02-1250	1 1/4"	100
Hangers				
	Install quickly and easily...bolt to mounting hole (bolts not included). Cable is secured to hanger by tightening adjusting screw.	TRA-03-500	1/2"	100
		TRA-03-875	7/8"	100
		TRA-03-1250	1 1/4"	100
Beam clamps (used with hangers)				
	Zinc plated steel C-clamps mount to beams without drilling holes. Features a case hardened hex-head cap-screw for positive grip on flange. Also capped back and bottom. Used with TRA-03.	TRA-04	All sizes	50
Aerial support ties with integral spacer				
	Designed to attach cable to a support cable. One piece construction with integral spacer reduces inventory costs of separate spacer and bands. Installs faster; lower installation costs. Releasable, reusable; One size fits all cables. Made of weather resistant polypropylene.	TRA-05	2" maximum	100
Nylon clamp ties				
	Designed to attach cable directly to the wall using a 1/4" fastener (not included). Can be screwed to the wall before tying cable. One size fits all cables.	TRA-06	2" maximum	100
50Ω loads				
	25 watt load for terminating cable runs. Has a Type N interface. Used with mating Type N connector.	TRA-07-NM TRA-07-NF	Attaches to Type N connector	1
Crimp tool				
	One crimp tool is required for 1/2" center pin. No tool is required for the 7/8" and 1 1/4" cable.	TRA-09	1/2"	1

TIMES MICROWAVE SYSTEMS

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Hardware Accessories

Mini Coax Support Blocks



Neatly stack coax into space saving bundles. Lower material cost by reducing hardware requirements.

Application: Coax Support
Size: 1/2" to 1-1/4" coax
Design: Two-run block hangers
Feature: Compact coax bundles
Mounts to: 3/8" or 10mm threaded rod
Material: Long glass polypropylene
Includes: Blocks only
Order Sep.: 3/8" or 10mm mounting hardware kits

	TMS part no.	Quant/pkg.	Weight lb (kg)
Mini coax support block for LMR-600	CB-600T	10	1.2 (0.5)
Mini coax support block for LMR-900	CB-900T	10	1.2 (0.5)
Mini coax support block for LMR-1200	CB-1200T	10	1.2 (0.5)
Mini coax support block for LMR-1700 coax	CB-1700T	10	1.7 (0.8)

Mounting Hardware Kits for Coax Support Blocks and Hanger Clamps



Pre-cut galvanized threaded rod hardware kits for stacking and installing mini coax support blocks.

Application: Coax Support
Size: 3/8"
Design: 1, 2, and 3-stack threaded rod kits
Feature: Stacks coax blocks
Mounts to: —
Material: Galv. (3/8") or stainless steel (10mm)
Includes: Threaded rod and hardware
Order Sep.: Additional accessories

	TMS part no.	Quant/pkg.	Weight lb (kg)
Hardware kit for LMR-600, 900, 1200 support blocks	HK-SSCB	10	1.8 (0.8)
Hardware kit for LMR-1700 support blocks	HK-SSCB-158	10	1.9 (0.9)
Hardware kit for mounting (2) mini coax support blocks for LMR-600, 900, 1200	HK-DSCB	10	2.3 (1.0)
Hardware kit for mounting (2) mini coax support blocks for LMR-1700	HK-DSCB-158	10	2.5 (1.1)
Hardware kit for mounting (3) mini coax support blocks for LMR-600, 900, 1200	HK-TSCB	10	2.8 (1.3)
Hardware kit for mounting (3) mini coax support blocks for LMR-1700	HK-TSCB-158	10	3.2 (1.5)

Adapter Bracket



Support coax blocks in wall mount applications.

Application: Coax Support
Size: 7/16" (11.1mm) holes
Design: Adapts hangers to flat surfaces
Feature: Compact design
Mounts to: —
Material: Stainless steel
Includes: Bracket
Order Sep.: Additional accessories

	TMS part no.	Quant/pkg.	Weight lb (kg)
Adaptor bracket	AB-CB	10	4.6 (2.1)

Stainless Steel Adapter Bracket



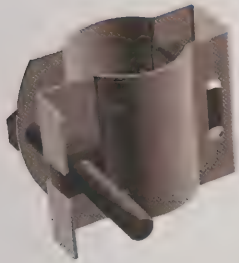
Adapt angled members for securing coax cables. Unique design easily converts to accommodate snap-in hangers.

Application: Coax Support
Size: 7/16" (11.1mm) holes
Design: Adapts hangers to flat surfaces
Feature: Fits any bolt-on hanger style
Mounts to: —
Material: Hot dip galv. steel,
Includes: Bracket
Order Sep.: Additional accessories

	TMS part no.	Quant/pkg.	Weight lb (kg)
Universal SST angle adapter	AB-CBH	1	2.3 (1.0)

Hardware Accessories

Butterfly Hangers

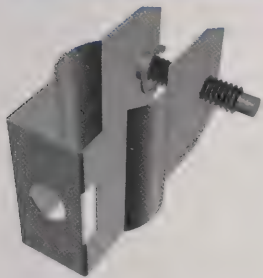


Butterfly hangers for standard non-snap-in installations.

Application: Coax Support
 Size: see chart
 Design: Bolt-on single run hanger
 Feature: Traditional hanger solution
 Mounts to: 7/16" (11.1mm) prepunched hole
 Material: Stainless steel
 Includes: Hangers and set bolts
 Order Sep.: Hanger hardware kits & additional accessories
Note: Hanger hardware kit not included; order separately

	TMS part no.	Quant/pkg.	Weight lb (kg)
Butterfly hanger for LMR-400	BH-38 NH	10	1.0 (0.5)
Butterfly hanger for LMR-600	BH-12 NH	10	1.0 (0.5)
Butterfly hanger for LMR-900	BH-58 NH	10	1.1 (0.5)
Butterfly hanger for LMR-1200	BH-78 NH	10	1.1 (0.5)
Butterfly hanger for LMR-1700	BH-114 NH	10	1.4 (0.6)

Standard Hangers

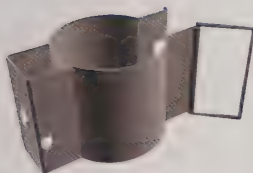


Standard hanger for reduced installation time

App.: Coax Support
 Size: See chart
 Design: Pre-formed bolt-on single run hanger
 Feature: Reduced installation time
 Mounts to: 7/16" (11.1mm) prepunched hole
 Material: Stainless steel
 Includes: Hangers and set bolts
 Order Sep.: Hanger hardware kits & additional accessories
Note: Hanger hardware kit not included; order separately

	TMS part no.	Quant/pkg.	Weight lb (kg)
Standard hanger for LMR-400	BH-S38 NH	10	0.8 (0.4)
Standard hanger for LMR-600	BH-S12 NH	10	0.8 (0.4)
Standard hanger for LMR-1200	BH-S78 NH	10	1.8 (0.8)
Standard hanger for LMR-1700	BH-S114 NH	10	1.1 (0.5)

Clip Hangers



Easy install solution

Application: Coax Support
 Size: See chart
 Design: Clip-on single run hanger
 Feature: Easy-to-install solution
 Mounts to: 7/16" (11.1mm) prepunched hole
 Material: Stainless steel
 Includes: Hangers and set bolts
 Order Sep.: Hanger hardware kits and additional accessories
Note: Hanger hardware kit not included; order separately

	TMS part no.	Quant/pkg.	Weight lb (kg)
Clip hanger kit for LMR-600	CH-12 NH	10	0.8 (0.4)
Clip hanger kit for LMR-1200	CH-78 NH	10	0.8 (0.4)
Clip hanger kit for LMR-1700	CH-114 NH	10	1.1 (0.5)

Universal Snap-in Hangers



Snap-in hangers simplify coax installation by eliminating the need for mounting hardware and installation tools.

Application: Coax Support
 Size: See chart
 Design: One-piece hanger solution
 Feature: Simplifies coax installation
 Mounts to: 3/4" (19.1mm) holes
 Material: Stainless steel
 Includes: Hangers
 Order Sep.: Additional mounting accessories

	TMS part no.	Quant/pkg.	Weight lb (kg)
Universal snap-in hanger for LMR-600	SH-U600T	10	0.7 (0.3)
Universal snap-in hanger for LMR-900	SH-U900T	10	1.0 (0.5)
Universal snap-in hanger for LMR-1200	SH-U1200T	10	1.2 (0.5)
Universal snap-in hanger for LMR-1700	SH-U1700T	10	1.3 (0.6)

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Hardware Accessories

Hanger Hardware Kits



Standard, clip and butterfly for flange attachment.

Application: Coax Support
 Size: 3/8" or 10mm
 Design: Hardware kit for hanger attachment to member
 Feature: —
 Mounts to: —
 Material: Stainless steel
 Includes: Bolts, nuts, lockwashers
 Order Sep.: Hangers

TMS part no. Quant/pkg. Weight lb (kg)

Hanger hardware kit, 3/8" x 3/4" slotted hex head bolts, lock washers and hex nuts	HK-34-10	10	0.5	(0.2)
Hanger hardware kit, 3/8" x 1" slotted head bolts lock washers and hex nuts	HK-100-10	10	0.6	(0.3)
Hanger hardware kit, 10mm x 20mm slotted head bolts lock washers and hex nuts	HK-M1020-10	10	0.5	(0.2)

Universal Angle Adapters



Adapt angled members for securing coax hangers.

Application: Coax Support
 Size: 3/4" (19.1mm) holes w/ 3/8" tapped insert
 Design: Adapts hangers to angle members
 Feature: Accepts snap-ins or 3/8" hardware
 Mounts to: Up to 7/8" (22mm) angle members
 Material: Stainless steel
 Includes: Adapters, set bolt, hanger hardware kit, avail. w/ or wo insert
 Order Sep.: Hangers

TMS part no. Quant/pkg. Weight lb (kg)

Universal angle adapter for snap-ins or 3/8" tapped holes	AA-U	10	4.9	(2.2)
Angle adapter, large version, with 3/8" threaded hardware	AA-US	10	4.7	(2.1)

Angle Adapters



Adapt angled members for securing coax hangers using 3/8" threaded hardware.

Application: Coax Support
 Size: 3/8" tapped holes
 Design: Adapts hangers to angle members
 Feature: High strength solution
 Mounts to: Up to 7/8" (22mm) angle members
 Material: Stainless steel
 Includes: Adapters, set bolt, hanger hardware kit
 Order Sep.: Hangers

TMS part no. Quant/pkg. Weight lb (kg)

Angle adapter with 3/8" tapped holes	AA-SL	10	5.4	(2.5)
Angle adapter with 10 mm tapped holes	AA-SL-M10	10	5.4	(2.5)

Stand-Off Adapters



Adapt and stand coax off 2" from round members. Unique design easily converts to accommodate snap-in hangers. Round member adaptors included unless noted.

Application: Coax Support
 Size: 3/8" or 10mm tapped hole
 Design: Adapts hangers to round members
 Feature: Provides 2" (50.8mm) stand-off
 Mounts to: Versions for 1" to 6" (25.4mm to 152.4mm) OD
 Material: Stainless steel
 Includes: Stand-offs, avail. w. or w.o. hose clamps
 Order Sep.: Hangers

TMS part no. Quant/pkg. Weight lb (kg)

Universal SST stand-off adaptor *	SA-38S	10	3.8	(1.7)
Universal SST stand-off adaptor for 1"-2" OD members	SA-38S100	10	3.8	(1.7)
Universal SST stand-off adaptor for 2"-3" OD members	SA-38S200	10	3.8	(1.7)
Universal SST stand-off adaptor for 3"-4" OD members	SA-38S300	10	4.0	(1.8)
Universal SST stand-off adaptor for 4"-5" OD members	SA-38S400	10	4.1	(1.9)
Universal SST stand-off adaptor for 5"-6" OD members	SA-38S500	10	4.4	(2.0)

* Round member adaptors not included

Snap-In Stand-Off Adapters



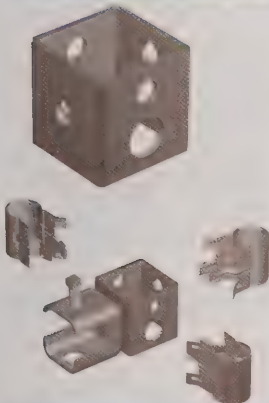
Adapt and stand coax off 2" from round members to avoid obstructions such as tower leg flanges and cross members

Application: Coax Support
Size: 3/4" (19.1mm) hole
Design: Adapts hangers to round members
Feature: Accepts snap-ins
Mounts to: Versions for 1" to 6" (25.4mm to 152.4mm) OD
Material: Stainless steel
Includes: Stand-offs, avail. with or without hose clamps
Order Sep.: Snap-ins

	TMS part no.	Quant/pkg.	Weight lb (kg)
Snap-In Stand-Off Adapter *	SA-SS	10	2.9 (1.3)
Snap-In Stand-Off Adapter for 1-2" (25.4mm-50.8mm) OD members	SA-SS100	10	3.8 (1.7)
Snap-In Stand-Off Adapter for 2-3" (50.8mm-76.2mm) OD members	SA-SS200	10	3.9 (1.8)
Snap-In Stand-Off Adapter for 3-4" (76.2mm-101.6mm) OD members	SA-SS300	10	4.0 (1.8)
Snap-In Stand-Off Adapter for 4-5" (101.6mm-127.0mm) OD members	SA-SS400	10	4.1 (1.9)
Snap-In Stand-Off Adapter for 5-6" (127.0mm-152.4mm) OD members	SA-SS500	10	4.1 (1.9)

* Round member adapters must be purchased separately

Mini Cluster Support Bracket



Mini Cluster bracket provides compact mounting support for a variety of different hanger types

Application: Coax Support
Size: 3/4" (19.1mm) and 7/16" (11.1mm) holes
Design: Three-run cluster bracket
Feature: Compact mounting solution
Mounts to: —
Material: Hot dip galv. steel
Includes: Bracket
Order Sep.: Hangers, mounting hardware

	TMS part no.	Quant/pkg.	Weight lb (kg)
Mini Cluster Support Bracket	CS-BS	10	4.4 (2.0)

Round Member Adapters



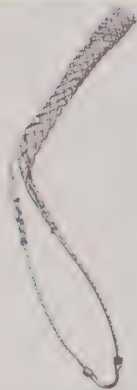
Adapt round members when securing most hanger styles.

Application: Coax Support
Size: 3/4" (19.1mm) and 7/16" (11.1mm) holes
Design: Three-run cluster bracket
Feature: Compact mounting solution
Mounts to: —
Material: Hot dip galvanized steel
Includes: Bracket
Order Sep.: Hangers, mounting hardware

	TMS part no.	Quant/pkg.	Weight lb (kg)
Round member adapter, 1"-2" OD	RMA-100	10	0.8 (0.4)
Round member adapter, 2"-3" OD	RMA-200	10	1.0 (0.5)
Round member adapter, 3"-4" OD	RMA-300	10	1.2 (0.5)
Round member adapter, 4"-5" OD	RMA-400	10	1.3 (0.6)
Round member adapter, 5"-6" OD	RMA-500	10	1.3 (0.6)
Round member adapter, 6"-8" OD	RMA-600	10	1.3 (0.6)

Hardware Accessories

Lace-up Hoisting Grips

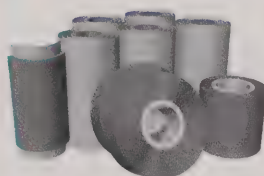


Hoisting Grips provide an effective method for lifting coax cables to the top of a tower where it is tied off to support the cable weight

Application: Coax Support
 Size: Versions for coax and elliptical waveguide
 Design: Mesh grip with single eye support
 Feature: Lace-up installation at any point on coax
 Mounts to: —
 Material: Tinned bronze
 Includes: Grip, self-locking clip, tape
 Order Sep.: —

	TMS part no.	Quant/pkg.	Weight lb	(kg)
Lace-up Hoisting Grip for LMR-400 Coaxial Cable	HG-400T	1	0.3	(1.0)
Lace-up Hoisting Grip for LMR-600 Coaxial Cable	HG-600T	1	0.3	(1.0)
Lace-up Hoisting Grip for LMR-900 Coaxial Cable	HG-900T	1	0.4	(0.2)
Lace-up Hoisting Grip for LMR-1200 Coaxial Cable	HG-1200T	1	0.6	(0.3)
Lace-up Hoisting Grip for LMR-1700 Coaxial Cable	HG-1700T	1	0.6	(0.3)

Universal Weatherproofing Kits

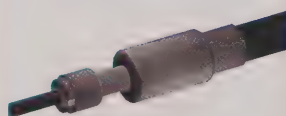


Mastic and electrical tape kit facilitates easy installation and provides a long-term environmental seal for connections.

Application: Coax Protection
 Size: —
 Design: Tape kit for multi-layer wrap
 Feature: Multi-connection protection
 Mounts to: —
 Material: Butyl and vinyl
 WK-XU
 Includes: Six (6) rolls mastic, 2-1/2" x 24" (64mm x 610mm)
 Two (2) rolls electrical tape, 3/4" x 66' (19mm x 20m)
 One (1) roll electrical tape, 2" x 20' (51mm x 6m)
 Order Sep.: —

	TMS part no.	Quant/pkg.	Weight lb	(kg)
Universal Kit (does 6 connections)	WK-XU	1	3.4	(1.5)
Vinyl-mastic Kit (does 2 connections)	WK-2	1	0.6	(0.3)

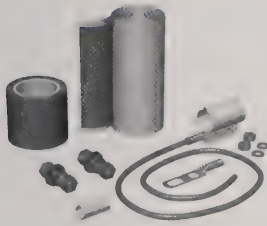
3M™ Cold Shrink™ Weatherproofing Kits



Avoid tapes and mastics with Cold Shrink™. This unique weatherproofing solution installs in less than three minutes, and eliminates the taping processes. Because no special techniques are required, Cold Shrink™ can be installed perfectly by both new and experienced installers. To apply, position the kit over a connection to form a long term environmental seat. A universally designed spacer accommodates similar coax sizes with tolerance variances allowing these kits to be used on a variety of manufacturers' coaxial cables regardless of your coax preference. Cold Shrink™ kits are available to seal main, feed, jumper and antenna connections.

	TMS part no.	Quant/pkg	Weight lb	(kg)
LMR-400 & LMR-600 (antenna interface)	CS-4060T	1	0.4	(0.2)
LMR-600 (antenna interface)	CS-A-600T	1	0.8	(0.4)
LMR-900 (antenna interface)	CS-A900T	1	0.8	(0.4)
LMR-1200 to LMR-400	CS-40120T	1	0.8	(0.4)
LMR-1200 to LMR-500	CS-50120T	1	0.8	(0.4)
LMR-1200 to LMR-600	CS-60120T	1	0.8	(0.4)
LMR-1200 to LMR-900	CS-90120T	1	0.8	(0.4)
LMR-1700 to LMR-400	CS-40170T	1	1.0	(0.5)
LMR-1700 to LMR-500	CS-50170T	1	1.0	(0.5)
LMR-1700 to LMR-600	CS-60170T	1	0.9	(0.4)
LMR-1700 to LMR-900	CS-90170T	1	0.9	(0.4)

Standard Ground Kits

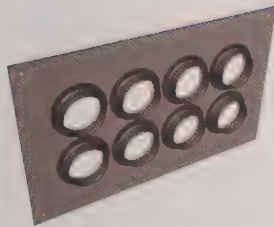


Pre-formed copper strap facilitates easy installation and protects coax from lightning strikes in excess of 200 kA

Application: Grounding
Size: Versions for coax and elliptical waveguide
Design: Bolt-on style with 5' (1.6m) lead / crimp lug
Feature: —
Mounts to: Coax outer conductor
Material: Copper or aluminum strap
Includes: Ground kit, lug, weatherproofing kit
Order Sep.: —

	TMS part no.	Quant/pkg.	Weight lb	(kg)
Standard Ground Kit for LMR-200 Coaxial Cable	GK-S200T	1	1.4	(0.6)
Standard Ground Kit for LMR-240 Coaxial Cable	GK-S240T	1	1.4	(0.6)
Standard Ground Kit for LMR-300 Coaxial Cable	GK-S300T	1	1.4	(0.6)
Standard Ground Kit for LMR-400 Coaxial Cable	GK-S400T	1	1.4	(0.6)
Standard Ground Kit for LMR-500 Coaxial Cable	GK-S500T	1	1.4	(0.6)
Standard Ground Kit for LMR-600 Coaxial Cable	GK-S600T	1	1.4	(0.6)
Standard Ground Kit for LMR-900 Coaxial Cable	GK-S900T	1	1.4	(0.6)
Standard Ground Kit for LMR-1700 Coaxial Cable	GK-S1700T	1	1.4	(0.6)

4" Feed-thru Entry Panels



Traditional panel for weather-tight building penetration

Application: Entry Port Solutions
Size: 20 configurations
Design: Entry plates with round ports
Feature: Easy to install solution
Mounts to: Walls
Material: Aluminum
Includes: Port, caps, mounting hardware
Order Sep.: 4" (101.6mm) Boot Assemblies

	TMS part no.	Quant/pkg.	Weight lb	(kg)
Entry Panel, 1 port, 1 x 1, standard	EP-220	1	1.0	(0.5)
Entry Panel, 1 port, 1 x 1, compact	EP-574	1	0.6	(0.3)
Entry Panel, 2 port, 1 x 2	EP-1448	1	2.3	(1.0)
Entry Panel, 3 port, 1 x 3	EP-1635	1	2.9	(1.3)
Entry Panel, 4 port, 1 x 4	EP-575	1	3.5	(1.6)
Entry Panel, 4 port, 2 x 2, standard	EP-1199	1	4.2	(1.9)
Entry Panel, 4 port, 2 x 2, compact	EP-1650	1	4.0	(1.8)
Entry Panel, 6 port, 2 x 3	EP-1449	1	6.1	(2.8)
Entry Panel, 6 port, 1 x 6	EP-1477	1	6.0	(2.7)
Entry Panel, 8 port, 2 x 4, standard	EP-576	1	6.1	(2.8)
Entry Panel, 8 port, 2 x 4, large	EP-1338	1	6.0	(2.7)
Entry Panel, 9 port, 3 x 3	EP-1033	1	7.1	(3.2)
Entry Panel, 10 port, 2 x 5	EP-1297	1	7.4	(3.4)
Entry Panel, 12 port, 3 x 4, standard	EP-1118	1	8.5	(3.9)
Entry Panel, 12 port, 3 x 4, large	EP-1334	1	7.0	(3.2)
Entry Panel, 12 port, 2 x 6	EP-1336	1	9.2	(4.2)
Entry Panel, 16 port, 4 x 4	EP-1447	1	9.1	(4.1)
Entry Panel, 18 port, 3 x 6	EP-1333	1	13.0	(5.9)
Entry Panel, 20 port, 4 x 5	EP-1861	1	11.0	(5.0)
Entry Panel, 24 port, 4 x 6	EP-1340	1	15.8	(7.2)

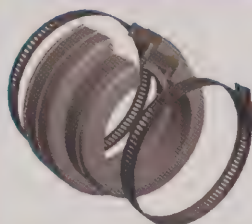
Note: Custom configurations available. Contact your sales administrator for details

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Hardware Accessories

Feed-Thru Boot Assemblies

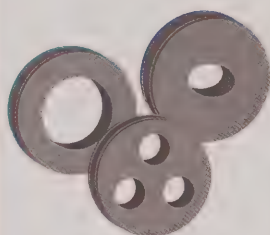


Innovative one-piece design simplifies installation. For use with EP-series feed-thru entry panels. Order cushion insert separately.

Application: Entry Port Solutions
Size: 4" (101.6mm) and 5" (127.0mm)
Design: Compression boot for aluminum entry panels
Feature: One-piece design simplifies installation
Mounts to: Entry panels
Material: EPDM rubber
Includes: Boot, two hose clamps
Order Sep.: Cushion Inserts, Entry Panel

	TMS part no.	Quant/pkg.	Weight lb	(kg)
4" Boot assembly, cushion not included	BA-400	1	1.3	(0.6)

Cushion Inserts



Standard port cushions are used with BA-400 boot assembly.

Application: Entry Port Solutions
Size: Versions for coax and elliptical waveguide
Design: Compression fit round cushions
Feature: Dependable seal
Mounts to: Feed-Thru Boot Assembly
Material: EPDM rubber
Includes: Cushion
Order Sep.: Boot Assembly, Entry Panel

	TMS part no.	Quant/pkg.	Weight lb	(kg)
Standard port cushion, blank (no holes)	SC-B	1	0.4	(0.2)
Standard port cushion with 6 holes for LMR-400 coax	SC-400T-6	1	0.4	(0.2)
Standard port cushion with 1 hole for LMR-600 coax	SC-600T-1	1	0.4	(0.2)
Standard port cushion with 2 holes for LMR-600 coax	SC-600T-2	1	0.4	(0.2)
Standard port cushion with 3 holes for LMR-600 coax	SC-600T-3	1	0.4	(0.2)
Standard port cushion with 4 holes for LMR-600 coax	SC-600T-4	1	0.4	(0.2)
Standard port cushion with 1 hole for LMR-900 coax	SC-900-1	1	0.4	(0.2)
Standard port cushion with 2 holes for LMR-900 coax	SC-900-2	1	0.4	(0.2)
Standard port cushion with 3 holes for LMR-900 coax	SC-900-3	1	0.4	(0.2)
Standard port cushion with 4 holes for LMR-900 coax	SC-900-4	1	0.4	(0.2)
Standard port cushion with 1 hole for LMR-1200 coax	SC-1200T-1	1	0.4	(0.2)
Standard port cushion with 2 holes for LMR-1200 coax	SC-1200T-2	1	0.4	(0.2)
Standard port cushion with 3 holes for LMR-1200 coax	SC-1200T-3	1	0.3	(0.1)
Standard port cushion with 1 hole for LMR-1700 coax	SC-1700T-1	1	0.3	(0.1)

Cushion Plugs



Cushion plugs are used to fill unoccupied holes.

Application: Entry Port Solutions
Size: 1/2" to 1-5/8" coax
Design: Plugs for unused cushion holes
Feature: Allows for future expansion
Mounts to: Cushion Inserts
Material: EPDM rubber
Includes: Plugs
Order Sep.: Cushion Inserts or Boot Assemblies

	TMS part no.	Quant/pkg.	Weight lb	(kg)
Cushion plug for LMR-400 coax	CP-400T	5	0.2	(0.1)
Cushion plug for LMR-600 coax	CP-600T	5	0.2	(0.1)
Cushion plug for LMR-900 coax	CP-900T	5	0.3	(0.1)
Cushion plug for LMR-1200 coax	CP-1200T	5	0.3	(0.1)
Cushion plug for LMR-1700 coax	CP-1700T	5	0.5	(0.2)

Installation Tools

	Part No.	Stock Code	Description	Qty
Crimp Tools				
 <p>HX-4</p>	HX-4	3190-200	Crimp Tool (handle only)	each
	Y197	3190-610	.213" hex dies for TC/EZ-195/200 crimp connectors	each
	Y375	3190-608	.255" hex dies for TC/EZ-240 crimp connectors	each
 <p>Y1719</p>	Y102	3190-611	.324" hex dies for TC/EZ-300 crimp connectors	each
	Y1719	3190-202	.429" hex dies for TC/EZ-400 crimp connectors	each
	Y151	3190-465	.532" hex dies for TC/EZ-500 crimp connectors	each
 <p>CT-400/300</p>	Y1720	3190-203	.610" hex dies for TC/EZ-600 crimp connectors	each
	CT-400/300	3190-666	Crimp tool for LMR-400 & LMR-300 connectors	each
	CT-240/200/100	3190-667	Crimp tool for LMR-240, LMR-200, LMR195 & LMR-100 connectors	each
Strip Tools				
 <p>ST-400C</p>	ST-400C	3190-228	Prep tool for LMR-400 clamp style connectors	each
	ST-400EZ	3190-401	Prep tool for LMR-400 crimp style connectors	each
	ST-500C	3190-229	Prep tool for LMR-500 clamp style connectors	each
 <p>ST-600C</p>	ST-600C	3190-230	Prep tool for LMR-600 clamp style connectors	each
	ST-600EZ	3190-310	Prep tool for LMR-600 crimp style connectors	each
	ST-900/1200C	3190-311	Prep tool for LMR-900 & 1200 clamp style connectors	each
 <p>ST-900/1200C</p>	ST-900C	3190-1310	Prep tool for LMR-900 clamp style connectors	each
	ST-1200C	3190-311	Prep tool for LMR-1200 clamp style connectors	each
	ST-1700C	3190-312	Prep tool for LMR-1700 clamp style connectors	each
 <p>ST-1700C</p>	RB-456	3190-421	Replacement blades for ST-400, 500 & 600 (pkg of 2)	each

TIMES MICROWAVE SYSTEMS

A Smiths Group plc company

	Part No.	Stock Code	Description	Qty
Midspan Strip Tools				
 <p>GST-600A</p>	GST-600A	3190-1051	Midspan strip tool for LMR-600 grounding kit	each
	GST-900A	3190-435	Midspan strip tool for LMR-900 grounding kit	each
	GST-1200A	3190-436	Midspan strip tool for LMR-1200 grounding kit	each
	GST-1700A	3190-437	Midspan strip tool for LMR-1700 grounding kit	each
Deburring Tool				
 <p>DBT-01</p>	DBT-01	3190-408	Deburring tool for LMR-400, 500 & 600 center conductors	each
Wrenches				
 <p>WR-1200A, WR1200B</p>	WR-600A	3190-1435	15/16" box wrench (one required for EZ-600-NMC-2)	each
	WR-600B	3190-1436	1" box wrench (one required for EZ-600-NMC-2)	each
	WR-900B	3190-509	1-1/4" box wrench (two required for EZ-900 connectors)	each
	WR-1200A	3190-512	1-9/16" box wrench (one required for EZ-1200 connectors)	each
	WR-1200B	3190-511	1-7/16" box wrench (one required for EZ-1200 connectors)	each
	WR-1700	3190-514	2" box wrench (two required for EZ-1700 connectors)	each
Tool Kits				
 <p>TK-400EZ</p>	TK-01	3190-731	Install tool kit for LMR-400/600 connectors (includes CCT-01, ST-400EZ, ST-600EZ, DBT-01, HX-4, .429" and .610" hex dies, tool pouch)	each
	TK-400EZ	3190-1602	Tool kit for LMR-400 crimp connectors (includes CCT-01, ST-400EZ, CT-400/300, DBT-01, tool pouch)	each
	TK-600EZ	3190-1602	Tool kit for LMR-600 crimp connectors (includes CCT-01, ST-600EZ, HX-4, Y1720, DBT-01, tool pouch)	each
Cable End Cutting Tools				
 <p>CCT-01</p>	CCT-01	3190-1544	Cable end flush cut tool	each
	RB-01	3190-1609	Replacement blades for CCT-01	each

Materials Abbreviations Legend

CONDUCTORS & BRAID MATERIALS

AL	Aluminum
BC	Bare Copper
BeCu	Beryllium-Copper Alloy 172
BCCAI	Bare Copper Clad Aluminum
CCS	Bare Copper Clad Steel
GS	Galvanized Steel
HR	High Resistance Wire
MW	Magnet Wire
NC	Nickel Covered Copper
SA	Silver Covered Alloy
SC	Silver Covered Copper
SCBeCu	Silver Covered Beryllium Copper
SCCadBr	Silver Covered Cadmium Bronze
SCCAI	Silver Covered Copper Clad Aluminum
SCCS	Silver Covered Copper Clad Steel
SNCCS	Silver Covered Nickel Covered Copper Clad Steel
SCS	Silver Covered Copper Strip
TC	Tinned Copper
TCCS	Tinned Copper Clad Steel

DIELECTRIC MATERIALS

PE	Solid Low Density Polyethylene
PTFE	Solid Polytetrafluoroethylene
LDTFE	Low Density PTFE
Foam PE	Gas Injected Foam PE
FEP	Solid Fluorinated Ethylene Propylene
CPT	Conductive PTFE
CPE	Conductive Polyethylene (Type A-5 per MIL-C-17)
Rubber	per MIL-C-17 (obsolete)
MGO	Magnesium Oxide

INTERLAYER MATERIALS

PE	Solid Polyethylene
PTFE	Solid Polytetrafluoroethylene
MY	Polyester
KP	Polyimide
ALMY	Aluminum-Polyester Laminate
ALKP	Aluminum-Polyimide Laminate
CPC	Copper-Polyester-Copper Laminate

JACKET MATERIALS

E-CTFE	Ethylene Chlorotrifluoroethylene Type XI per MIL-C-17
ETFE	Ethylene Tetrafluoroethylene Copolymer Type X per MIL-C-17
FEP	Fluorinated Ethylene Propylene Type IX per MIN-C-17
FG Braid	Fiberglass; Impregnated Type V per MIL-C-17
PE	Clear Polyethylene Type III per MIL-C-17
LS/LT	Low Smoke/Low Toxicity (XLPE)
PE	Polyethylene, black HMW Type IIIA per MIL-C-17
PFA	Perfluoroalkoxy Type XIII per MIL-C-17
PTFE	Polytetrafluoroethylene Type VIIA per MIL-C-17
PUR	Polyurethane, black Type XII per MIL-C-17
PVC-I	Polyvinyl Chloride, black (contaminating) Type 1 per MIL-C-17
PVC-II	Polyvinyl Chloride, grey (non-contaminating) Type II per MIL-C-17
PVC-IIA	Polyvinyl Chloride, black (non-contaminating) Type IIA per MIL-C-17
Rubber	Per MIL-C-17 (obsolete)
SIL/DAC	Dacron Braid over Silicone Rubber Type VI per MIL-C-17
TPE	Thermo Plastic Elastomer
XLPE	Crosslinked Polyolefin Type XIV per MIL-C-17

Coaxial Cable Equations Legend

Symbol	Definition	Units	Symbol	Definition	Units
α	= Attenuation in dB/100 feet	dB/100 feet	Fco	= Cutoff frequency	GHz
ϵ	= Dielectric constant		C	= Braid carriers	
Γ	= Reflection coefficient		N	= Braid ends per carrier	
ϕ	= Electrical length	degrees	t	= Flat strip thickness	inches
C	= capacitance	pF/foot	w	= Flat strip width	inches
L	= Inductance	uH/foot	SRL	= Return loss	dB
Zo	= Impedance	ohms	VSWR	= Voltage standing wave ratio	
Vp	= Velocity of propagation	%	FWD	= Forward power	dB
df	= Dissipation factor		RFL	= Reflected power	dB
Td	= Time delay	nS/foot	MML	= Mismatch loss	dB
F	= Frequency	MHz	ME	= Match efficiency	%
PTC	= Phase temperature coefficient	ppm/C	k_s	= 1.0 for solid center conductor	
ΔT	= Change in temperature (t2 to t1)	C		= 0.939 for 7 strand center conductor	
LTH	= Length	feet		= 0.97 for 19 strand center conductor	
$\Delta\phi$	= Change in electrical length (t1 to t2)	degrees	log	= logarithm to base 10	
D	= dielectric diameter	inches	ln	= logarithm to base e	
d	= center conductor diameter	inches	k₁	= resistive loss constant	
ds	= Braid wire size	inches	k₂	= dielectric loss constant	
Fbd	= Braid factor				

Coax Cable Design Equations

Impedance (ohms)

$$Z_0 = 138 V_p \log \left(\frac{D}{d \cdot k_s} \right) = 60 V_p \ln \left(\frac{D}{d \cdot k_s} \right)$$

$$Z_0 = \frac{138}{\sqrt{\epsilon}} \log \left(\frac{D}{d \cdot k_s} \right) = \frac{60}{\sqrt{\epsilon}} \ln \left(\frac{D}{d \cdot k_s} \right)$$

$$Z_0 = \sqrt{LC}$$

Velocity of Propagation and Dielectric Constant

$$V_P = \frac{1}{\sqrt{\epsilon}} \quad \epsilon = \frac{1}{V_P^2}$$

Time Delay (nS/foot)

$$T_d = \frac{1.016}{V_P} = 1.016 \sqrt{\epsilon}$$

Capacitance (pF/foot)

$$C = \frac{7.36 \epsilon}{\log \left(\frac{D}{d \cdot k_s} \right)} = \frac{16.95 \epsilon}{\ln \left(\frac{D}{d \cdot k_s} \right)}$$

$$C = \frac{7.36}{V_P^2 \log \left(\frac{D}{d \cdot k_s} \right)} = \frac{16.95}{V_P^2 \ln \left(\frac{D}{d \cdot k_s} \right)}$$

$$C = \frac{1016}{Z_0 \cdot V_P}$$

Inductance (uH/foot)

$$L = .140 \log \left(\frac{D}{d \cdot k_s} \right) = .0606 \ln \left(\frac{D}{d \cdot k_s} \right)$$

$$L = \frac{Z_0^2 \cdot C}{1 \times 10^6}$$

Attenuation (dB/foot)

$$\alpha = \frac{.4343}{Z_0 \cdot D} \left[\frac{D}{d \cdot k_s} + F_{bd} \right] \sqrt{F} + \frac{2.78 \cdot df \cdot F}{V_P}$$

$$\alpha = k_1 \sqrt{F} + k_2 F$$

Braid Factor

$$\text{Round Wire Braid: } F_{bd} = \frac{8D + 16 \, ds}{C \cdot N \cdot ds}$$

$$\text{Flat Strip Braid: } F_{bd} = \frac{2\pi (D + 2t)}{C \cdot W}$$

$$\text{Solid Tube: } F_{bd} = 1.0$$

Cutoff Frequency (GHz)

$$F_{co} = \frac{7.5 \cdot V_p}{(D + (d \cdot k_s))}$$

$$F_{co} = \frac{7.5}{\sqrt{\epsilon} (D + (d \cdot k_s))}$$

Electrical Length (degrees)

$$\phi = \frac{360 \cdot F \cdot L_{TH}}{984 \cdot V_p}$$

$$\phi = \frac{360 \cdot F \cdot L_{TH} \cdot \sqrt{\epsilon}}{984}$$

Phase Temperature Coefficient (ppm/C°)

$$PTC = \frac{\Delta \phi \cdot 1 \times 10^6}{\phi \cdot \Delta T}$$

Phase Stability (degrees)

$$Df = \frac{PTC \cdot \phi \cdot \Delta T}{1 \times 10^6}$$

Return Loss (dB)

$$RL = -20 \log \Gamma$$

$$RL = -20 \log \frac{VSWR-1}{VSWR+1}$$

$$RL = -10 \log \frac{RFL}{FWD}$$

VSWR

$$VSWR = \frac{1 + \Gamma}{1 - \Gamma}$$

$$VSWR = \frac{1 + 10^{RL/20}}{1 - 10^{RL/20}}$$

$$VSWR = \frac{1 + \sqrt{RFL/FWD}}{1 - \sqrt{RFL/FWD}}$$

Reflection Coefficient

$$G = 10^{-RL/20}$$

$$G = \frac{VSWR - 1}{VSWR + 1}$$

$$G = \sqrt{RFL/FWD}$$

Match Efficiency (%)

$$ME = (1 - \Gamma^2) \cdot 100$$

$$ME = \left[1 - \left(\frac{VSWR - 1}{VSWR + 1} \right)^2 \right] \cdot 100$$

$$ME = \left(\frac{FWD - REL}{FWD} \right) \cdot 100$$

Match Efficiency (%)

$$MML = -10 \log (1 - \Gamma^2)$$

$$MML = -10 \log \left[1 - \left(\frac{VSWR - 1}{VSWR + 1} \right)^2 \right]$$

$$MML = -10 \log \left(1 - \frac{RFL}{FWD} \right)$$

General Electrical Properties

	Cable Type	Impedance (ohms)	Capacitance (pF/foot)	Velocity (%)	Dielectric Constant	Time Delay (nS/foot)
50 OHM	Solid Polyethylene	50	30.8	65.9	2.30	1.54
	Foam PE	50	24.5	83.0	1.45	1.22
	Foam PE	50	24.2	84.0	1.42	1.21
	Foam PE	50	23.9	85.0	1.38	1.20
	Foam PE	50	23.6	86.0	1.35	1.18
	Foam PE	50	23.3	87.0	1.32	1.17
	Foam PE	50	23.1	88.0	1.29	1.16
	Solid PTFE	50	29.2	69.5	2.07	1.46
	Tape PTFE	50	28.6	71.0	1.98	1.43
	Low Density PTFE	50	26.7	76.0	1.73	1.34
	Low Density PTFE	50	25.4	80.0	1.56	1.27
75 OHM	Solid Polyethylene	75	20.6	65.9	2.30	1.54
	Foam PE	75	16.3	83.0	1.45	1.22
	Foam PE	75	16.1	84.0	1.42	1.21
	Foam PE	75	15.9	85.0	1.38	1.20
	Foam PE	75	15.8	86.0	1.35	1.18
	Foam PE	75	15.6	87.0	1.32	1.17
	Foam PE	75	15.4	88.0	1.29	1.16
	Solid PTFE	75	19.5	69.5	2.07	1.46
	Low Density PTFE	75	17.8	76.0	1.73	1.34
	Low Density PTFE	75	16.9	80.0	1.56	1.27
MISC	Solid Polyethylene	95	16.2	65.9	2.30	1.54
	Foam PE	95	12.6	85.0	1.38	1.20
	Air Spaced PE	95	12.6	85.0	1.38	1.20
	Solid PTFE	95	15.4	69.5	2.07	1.46
	Air Spaced PE	125	09.6	85.0	1.38	1.20
	Air Spaced PE	185	06.5	85.0	1.38	1.20

Properties of Wire and Cable Insulating Materials

Material	Dielectric Constant	Dissipation Factor	Volume- Resistivity (ohm-cm)	Operating Temperature (Range °C)
PTFE	2.07	0.0003	10 ^{19th}	-75 to +250
Polyethylene	2.3	0.0003	10 ^{16th}	-65 to +80
Foam Polyethylene	1.29 - 1.64	0.0001	10 ^{12th}	-65 to +100
Polyvinylchloride	3.0 - 8.0	0.07 - 0.16	2 x 10 ^{12th}	-50 to +105
Polyamide	3.5 - 4.6	0.03 - 0.4	4 x 10 ^{14th}	-60 to +120
Silicone Rubber	2.1 - 3.5	0.007 - 0.016	10 ^{13th}	-70 to +250
Ethylene Propylene	2.24	0.00046	10 ^{17th}	-40 to +105
FEP	2.1	0.0007	10 ^{18th}	-70 to +200
Low Density PTFE	1.38 - 1.73	0.00005	10 ^{19th}	-75 to +250
Foam FEP	1.45	0.0007	10 ^{18th}	-75 to +200
Polyimide	3.0 - 3.5	0.002 - 0.003	10 ^{13th}	-75 to +300
PFA	2.1	0.001	10 ^{16th}	-75 to +260
ETFE	2.6	0.005	10 ^{16th}	-75 to +150
ECTFE	2.5	0.0015	10 ^{16th}	-65 to +150
PVDF	7.8	0.02	10 ^{14th}	-75 to +125

A guide to the selection of RF coaxial cable

Choosing the best coaxial cable for a new application requires an understanding of the application and of the range of cables to choose from. The best choice can only be arrived at by a careful evaluation of the performance and cost trade-offs. Our in-depth expertise in all aspects of coaxial cable technology can help you to arrive at the best choice for your application.

Times Microwave Systems offers the broadest range of coaxial cables of any manufacturer. We also have the expertise to design and produce custom cables if there is no design available for your application.

In choosing the best coaxial cable for an application, the cable characteristics listed below should be considered. The following sections provide detailed discussions of each characteristic.

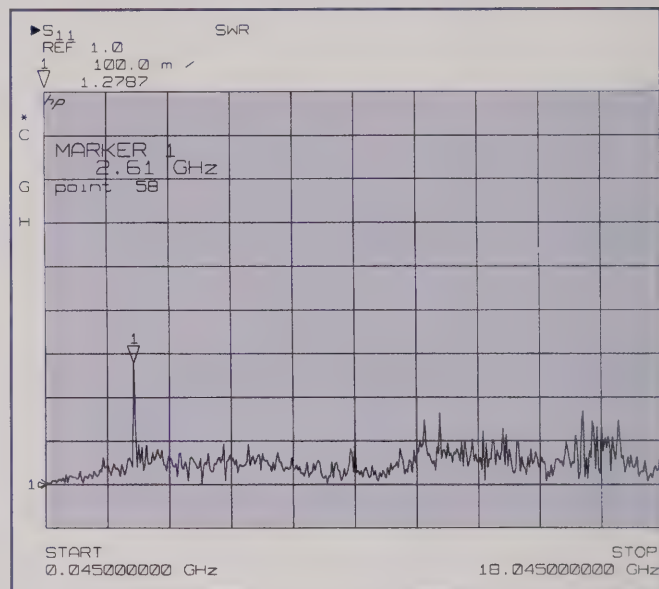
- A:** Characteristic Impedance
- B:** VSWR & Impedance Uniformity
- C:** Attenuation
 - Attenuation Uniformity
 - Attenuation Stability
- D:** Power Rating
- E:** Operating Voltage
- F:** Shielding
- G:** Capacitance
- H:** Velocity of Propagation
- I:** Electrical Length Stability
- J:** Cut-Off Frequency
- K:** Pulse Response
- L:** Self-Generated Cable Noise
- M:** Operating Temperature Range
- N:** Flexibility
- O:** Environmental Resistance
- P:** Cable Strength
- Q:** Qualification & UL Approval

Table 1 provides various formulae describing cable characteristics.

A. CHARACTERISTIC IMPEDANCE

The characteristic impedance of a coaxial cable is determined by the ratio of the diameter of the outer conductor to the inner conductor and the dielectric constant of the insulating material between the conductors. Be-

Fig. 1
VSWR vs. Frequency



cause the RF energy in the cable travels on the surface of the conductors, the important diameters are the outside diameter of the center conductor and the inside diameter of the outer conductor. Impedance is selected to match the system requirements.

The most common coaxial cables impedances are 50, 75, and 95 ohm. Other impedances from 35 to 185 ohms are sometimes used. Fifty ohm cables are used in microwave and wireless communications applications. Seventy-five ohm cables are typically used in cable television applications and video applications. Ninety-five ohm cables are typically used for data transmission applications.

For best system performance, the cable must be selected to match the impedance of the other components in the system. Of the most commonly used coaxial cables, 75 ohms impedance provides the lowest attenuation and 35 ohms impedance provides the best power handling. For practical cables with non-ideal dielectrics and conductors, these differences are small. The availability of required components and cables with the appropriate characteristic impedance is usually the prime factor in selecting a given system impedance.

B. SIGNAL REFLECTION: VSWR, RETURN LOSS, REFLECTION FACTOR & IMPEDANCE UNIFORMITY

There are three things that happen to RF energy input into a coaxial cable assembly:

1. It is transmitted to the other end of the cable, as is usually desired.
2. It is lost along the length of the cable either by being transformed into heat or by leaking out of the cable.
3. It is reflected back towards the input end of the cable.

Table 2
VSWR Conversions

VSWR (:1)	Return Loss (dB)	Reflection Coefficient	Mismatch Loss (dB)	Match Efficiency (%)
1.011	45	0.006	0.000	100.00
1.020	40	0.010	0.000	99.99
1.036	35	0.018	0.001	99.97
1.065	30	0.032	0.004	99.90
1.074	29	0.035	0.005	99.87
1.08	28	0.400	0.007	99.84
1.09	27	0.045	0.009	99.80
1.11	26	0.050	0.011	99.75
1.12	25	0.056	0.014	99.68
1.13	24	0.063	0.017	99.60
1.15	23	0.071	0.022	99.50
1.17	22	0.079	0.027	99.37
1.20	21	0.089	0.035	99.21
1.22	20	0.100	0.044	99.00
1.25	19	0.112	0.055	98.74
1.29	18	0.126	0.069	98.42
1.33	17	0.141	0.088	98.00
1.38	16	0.158	0.110	97.49
1.43	15	0.178	0.140	96.84
1.50	14	0.200	0.176	96.02
1.58	13	0.224	0.223	94.99
1.67	12	0.251	0.283	93.69
1.78	11	0.282	0.359	92.06
1.92	10	0.316	0.458	90.00
2.10	9	0.355	0.584	87.41
2.32	8	0.398	0.749	84.15
2.61	7	0.447	0.967	80.05
3.01	6	0.501	1.256	74.88
3.57	5	0.562	1.651	68.38
4.42	4	0.631	2.205	60.19
5.85	3	0.708	3.021	49.88

Match efficiency - e.g. 100 Watts Forward Power at 1.33:1 VSWR yields 98 Watts Output (i.e. 2 Watts Reflected)

Reflections back towards the input end of the cable are caused by variations in impedance along the length of the cable assembly. This includes differences in impedance between the cable and the devices to which it is attached. Typically the connectors and the interface between the connectors and the cable will be major contributors to the reflection. The cable itself can also contribute to the reflections. One source of cable reflections is periodic variations in impedance which result from the manufacturing process and add up at a specific frequency. When viewed in a sweep over a range of frequencies this will show up as a spike. An example of a spike is shown in Figure 1.

The magnitude of a reflection can be expressed in several ways. Perhaps the most familiar is VSWR or Voltage Standing Wave Ratio. A value of 1.0:1 or just 1.0 indicates no reflected power or a perfect cable. Alternatively, the reflection can be expressed as return loss—the ratio of the reflected power to the input power usually expressed in decibels. Table 1 gives the formulas to convert between VSWR, return loss and reflection coefficient. A tabulation of the equivalent values of all three measures is also provided in Table 2.

The lack of reflected power (or low VSWR) is often used as a figure of merit for coaxial components, including cables, connectors and cable assemblies. It is indicative of how well the uniformity of the cable is maintained along its length, whether the connectors are properly designed and attached and how well the transitions between line sizes are compensated for in the connectors. It is generally a function of frequency, with reflections generally getting higher as the frequency increases.

In many applications, low reflected power is critical for proper system performance. In these cases, it is essential that this be considered in the selection of the cable and connectors. In addition, care must be taken to properly attach the connectors to the cable in order to achieve the proper results. Purchase of completed, factory assembled and tested cable assemblies should be considered for VSWR critical applications.

Note that actual input impedance at a particular frequency may be quite different from the characteristic impedance of the cable due to reflections in the line. The Voltage Standing Wave Ratio (or VSWR) of a particular

A guide to the selection of RF coaxial cable

length of cable is an indicator of the difference between the actual input impedance of the cable and its average characteristic impedance.

The impedance of long lengths of cable will exhibit very little change over their operating temperature ranges - less than 2%.

It is possible to fabricate cables having a characteristic impedance that varies through the length of the cable for matching purposes. Thus a coaxial cable can be used as a broadband impedance transformer to match differing source and load impedances. The transforming action is related to cable length and the minimum operating frequency, and the cable must be designed for the specific application.

C. ATTENUATION

Attenuation is the loss of signal along the length of a cable. As the RF signal passes through the cable, a portion of the signal is converted to heat and a portion of the signal leaks out of the cable through the outer conductor. This

Fig. 2
Attenuation Temperature
Correction Factor

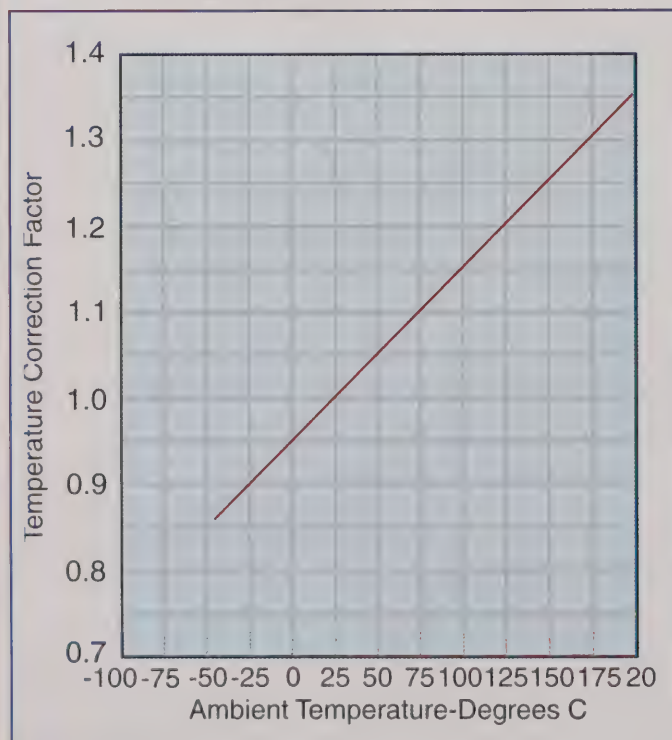
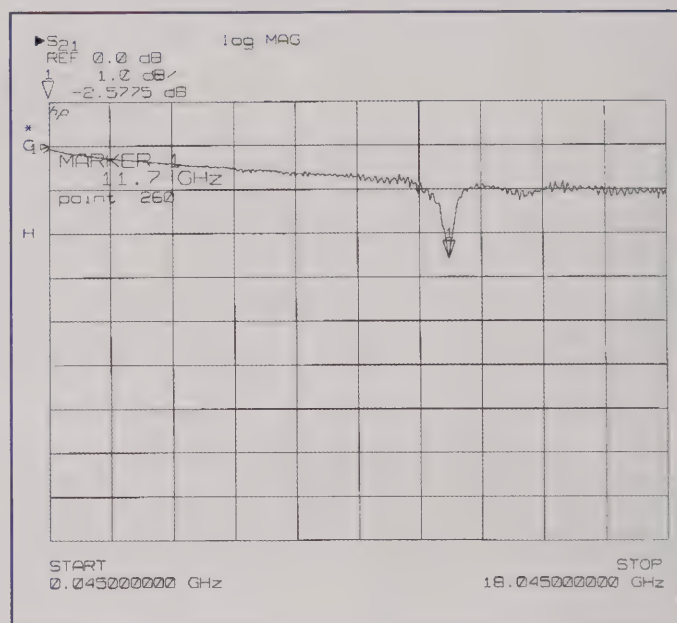


Fig. 3
Attenuation vs. Frequency



loss of signal is usually expressed in decibels per unit of length at a specific frequency, since attenuation increases with frequency.

For most applications, the objective is to minimize the losses in the cable runs or to stay within a loss budget. Minimum loss corresponds to an attenuation of 0 dB or a ratio of 1 to 1 between input and output power. Because cable losses decrease with increasing cable diameter for the same type of construction, minimizing cable loss means maximizing cable size.

Attenuation is determined by the conductive and dielectric losses of the cable. Larger cables have lower conductor losses, reducing attenuation. Dielectric loss is independent of size. Dielectric losses increase linearly with frequency, while conductor losses increase with the square root of frequency. Therefore, dielectric losses become a larger proportion of the total cable loss as frequency increases.

Attenuation must be modified by a correction factor for the ambient temperature (see Figure 2). Elevated temperature increases cable attenuation by increasing the resistance of the conductors and by increasing the power factor of the dielectric (see Figure 6 for correction factors).

To select a cable construction for a particular applica-

tion, determine the desired attenuation at the highest frequency from system requirements. Determine the corrected attenuation by dividing the desired attenuation by the temperature correction factor. Choose the smallest cable meeting the corrected attenuation value from the tables.

For cables with low attenuation for their size, see the LMR, StripFlex, SFT, and CLL families of cables.

Attenuation Uniformity

The attenuation of any cable may not change uniformly as the frequency changes. Random and periodic impedance variations give rise to random and periodic attenuation responses. Narrow-band attenuation "spikes" such as that shown in Figure 3 can occur. If required, cables can be procured in various lengths where a maximum attenuation variation from nominal is specified over a customer defined frequency range.

Attenuation Stability

The attenuation of braided cables can increase with time and flexure. The change with time can be caused by

Fig. 4
Attenuation vs. Flexure

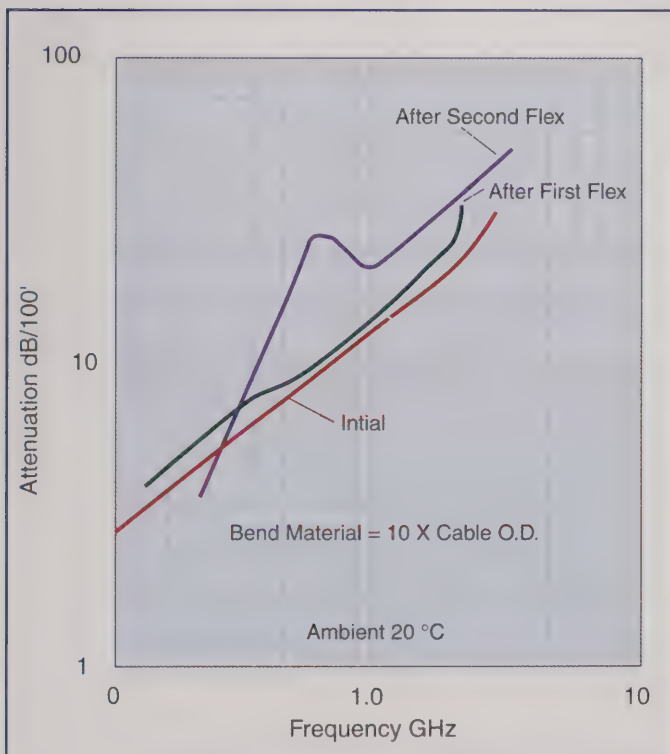
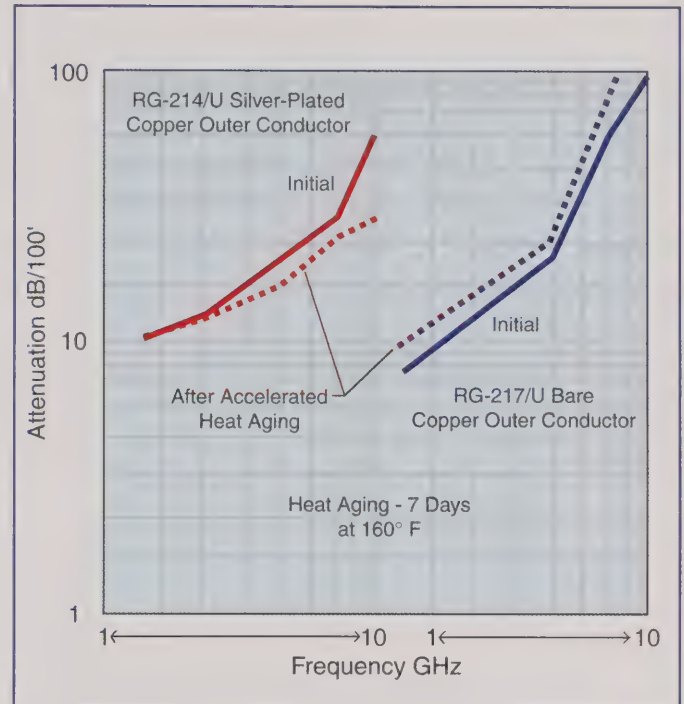


Fig. 5
Attenuation Stability



corrosion of the braided shield, by contamination of the primary insulation due to jacket plasticizers, and by moisture penetration through the jacket. These effects can be essentially eliminated by encapsulating the braid with an appropriate flooding compound, as is done in the DB versions of the LMR cables. (Vapor penetration occurs at differing rates through all plastic and elastomeric materials.) Attenuation degradation is more pronounced at frequencies above 1 GHz. Cables having bare copper and tinned copper braids exhibit far greater attenuation degradation than cables with silver plated braids. These effects are illustrated in Figure 5.

The following guidelines apply:

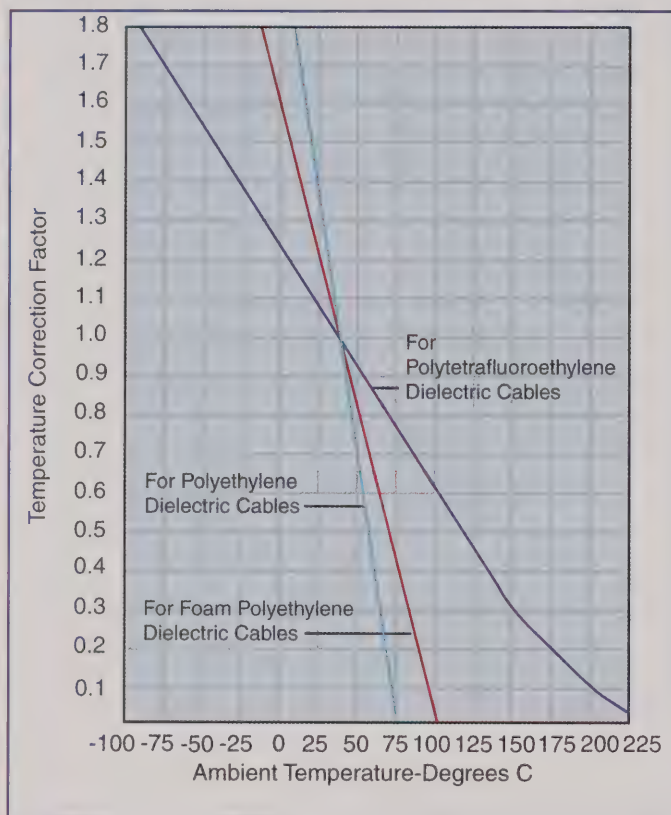
a. Tin plated braids: Below 1 GHz, cables manufactured with tin plated braids have 15-20% more attenuation than bare copper braids in the "as manufactured" condition, but are more stable than bare copper braided cables.

b. Foam polyethylene: Flexible braided cables with foam polyethylene dielectrics have approximately 15 to 40% lower attenuation than solid polyethylene cables of the same core size and impedance. However, some polyethylene foams can absorb moisture causing attenuation

A guide to the selection of RF coaxial cable

Fig. 6

Power Temperature Correction Factor



tion of heat in the center and outer conductors, as well as in the dielectric core. The power handling capability of a cable is related to the ability of the cable to dissipate this heat. The ultimate limiting factor in power handling is the maximum allowable operating temperature of the materials used in the cable, especially the dielectric. This is because most of the heat is generated at the center conductor of the cable. In general, the power handling capability of a given cable is inversely proportional to its attenuation, and directly related to its size. The other factor is the heat transfer properties of the cable, especially the dielectric.

Cable power ratings must be derated by correction factors for the ambient temperature, altitude and VSWR encountered in a particular application. High ambient temperature and high altitude reduce the power rating of a cable by impeding heat transfer out of the cable. VSWR reduces power rating by causing localized hot spots in the cable.

To select the cable construction for a particular requirement, determine the average input power at the highest frequency from system requirements. Then determine the effective average input power as follows:

$$\text{Effective Power} = \frac{\text{Average Power} \times (\text{VSWR correction})}{(\text{Temp. correction}) \times (\text{Alt. correction})}$$

Temperature and altitude corrections are shown on Figures 6 and 7.

increases. LMR cables utilize a closed cell, non-hydroscopic foam composition and are not subject to this problem.

See LMR cables.

c. If PVC jackets are used, a Type IIA, non-contaminating PVC should be specified for applications where attenuation uniformity over time is important. Type I PVC's contain plasticizers which can leach into the dielectric over time causing an increase in attenuation.

d. The ultimate in attenuation stability can be achieved by specifying hermetically-sealed cable assemblies. These will preclude the ingress of contaminants of any sort into the cable and result in the best stability, such as MilTech assemblies. Contact Times Microwave for more information on this type of assembly.

For flexible cables in extreme environmental conditions, a protected braid (e.g. LMR-DB) is recommended.

D. AVERAGE POWER RATING

Electrical losses in a coaxial cable result in the genera-

Fig. 7
Power Altitude Correction Factor

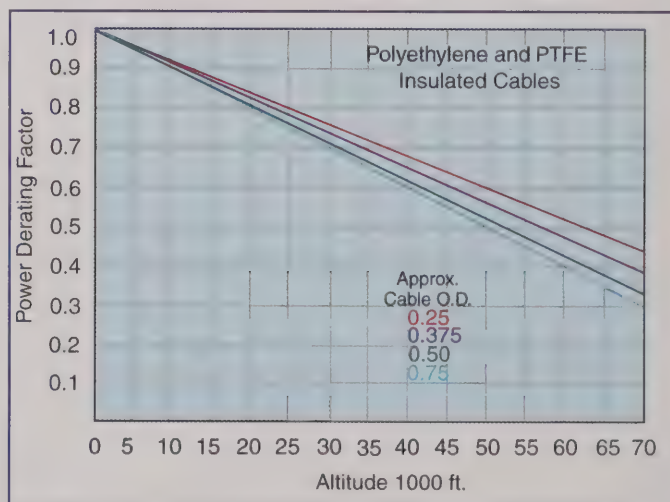
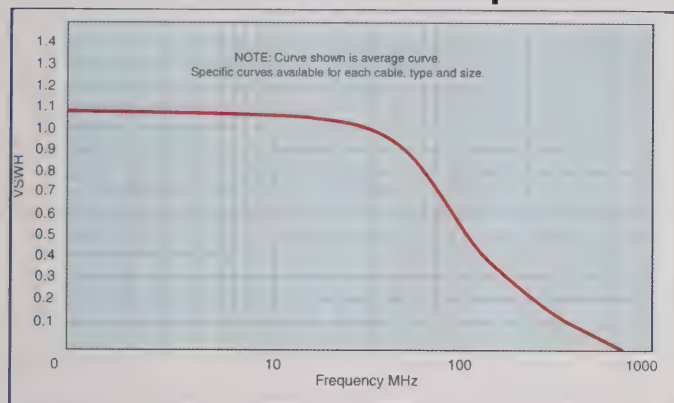


Fig. 8
Second VSWR
Correction Factor Multiplier K



VSWR correction factor =

$$\frac{1}{1/2 (\text{VSWR} + \text{VSWR}) + 1/2 k_1 (\text{VSWR} - \text{VSWR})}$$

Where k, is shown in Figure 8. Select a cable from the Attenuation and Power charts rated at this effective power level.

Note that the peak power handling capability of a cable is related to the maximum operating voltage rating. See Section E, below.

E. MAXIMUM OPERATING VOLTAGE

Care must be taken to ensure that the continuous voltage (and the peak voltage related to pulsed power conditions) applied to a cable is held below its maximum voltage rating. Note that there are two separate voltage ratings for a cable: Corona Voltage and Dielectric Withstanding Voltage:

1. Corona is a voltage related ionization phenomenon which causes noise generation, long term dielectric damage, and eventual breakdown of the cable. Thus, a cable cannot operate continuously with corona, and the maximum operating voltage must be less than the corona extinction level (extinction voltage) of the cable. The determination of corona voltages requires sensitive instrumentation capable of detecting the voltage induced ionization noise generation.
2. The Dielectric Withstanding Voltage, or dielectric

strength of the cable, is a measure of the voltage level required to abruptly break down the dielectric employed in a cable. DWV testing requires less sensitive instrumentation, and is a test measurement where a voltage is applied to the cable for a limited time only, and monitored for current flow.

Maximum operating A.C. (RMS) voltage levels or peak voltage are given for each construction in the Cable Data Section of this catalog. The maximum permissible D.C. voltage level is conservatively 3 times the A.C. level.

To select a cable for a particular application, determine the actual RMS (peak /1.4),

$$\text{RMS voltage} = \frac{(\text{peak voltage value})}{1.4}$$

or actual peak voltage = (RMS x value 1.4)

from system requirements. Then determine the effective input voltage by multiplying the actual input voltage by the square root of the VSWR:

$$\text{Effective voltage} = \text{Actual voltage} \times (\text{VSWR})^{1/2}$$

Then select a cable with a maximum operating voltage greater than the effective RMS voltage. Maximum operating voltages are listed in the cable data section.

As the altitude where a cable is being used increases, the maximum operating voltage of a completed cable assembly is reduced due to the reduction in dielectric strength of the lower pressure air in the termination area.

F. SHIELDING AND CROSS-TALK (OR ISOLATION)

1. The shielding efficiency of a coaxial cable depends on the construction of its outer conductor. The most common constructions available are:

Single Braid: Consisting of bare, tinned, or silver plated round copper wires (70 to 95% coverage).

Double Braid: Consisting of two single braids as described above with no insulation between them.

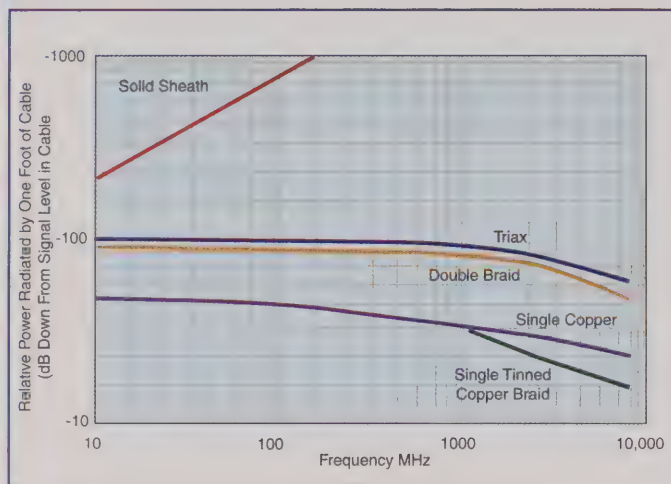
Triaxial: Consisting of two single braids as described above with a layer of insulation between them.

Strip Braids: Consists of flat strips of copper rather than round wires (90% coverage).

Strip Outer Conductors/Spiral Flat Strips: Exhibiting @ 100% coverage.

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Fig. 9
Shielding Effectiveness



Solid Sheath: Consisting of aluminum or copper tubing (100% coverage).

2. The relative shielding effectiveness of these constructions are illustrated in Figure 9 over the frequency range from 10 MHz to 8 GHz. This graph shows the level of signal which leaks through the outer shield of a one foot sample of each construction. The curves describing the performance of the flexible cables, i.e., the triax braid, double braid, and single braid construction are based on measured data.

To estimate the total leakage in cables under 1100 ft. long, add $20 \log L$ to the figure read from the graph (where L is the cable length in feet). The curve showing the typical performance of the semi-flexible (or solid sheath) cables is based on theory. In practice the shielding efficiency of interconnections made using semi-flexible (solid sheath) cables is limited by the leakage at the connectors.

3. The isolation (or cross talk) between two coax cable runs is the sum of the isolation factors of the two cables and the isolation due to the "coupling factor" between the runs. This coupling factor will depend on the relative spacing, positioning and environment of the cable runs and on the grounding practices employed. The coupling factor will substantially affect the isolation between the cable runs.

4. Measurements show that the RF(1 -30 MHz) cross

talk between two single braided coaxes over a 20 foot run length is approximately 80 db down from the signal level inside the cables. The coaxes were laid side-by-side over the 20 foot test length. (This test data illustrates the affect of the "coupling factor" noted above.)

5. Special Constructions that provide enhanced shielding characteristics are available. These cables include the LMR, RD, and RDT families of cables, and the StripFlex, SFT, and TFlex cables.

G. CAPACITANCE

Capacitance in a cable is related to the dielectric material and the characteristic impedance. Typical capacitance values are shown in the General Electrical Properties on page 182 for some common coaxial lines.

As seen in the table, the higher impedance cables provide lower "capacitance per foot" values, resulting in reduced loading for data communications applications.

H. VELOCITY OF PROPAGATION

The velocity of propagation in a coaxial cable is determined primarily by the dielectric constant of the insulating material between the inner and outer conductors. This property is usually expressed as a percentage of the velocity of light in free space, and is typically noted as V_g or V_p .

The General Electrical Properties on page 182 shows the velocity of propagation and time delay of cables insulated with commonly used dielectrics.

Fig. 10
Phase Stability

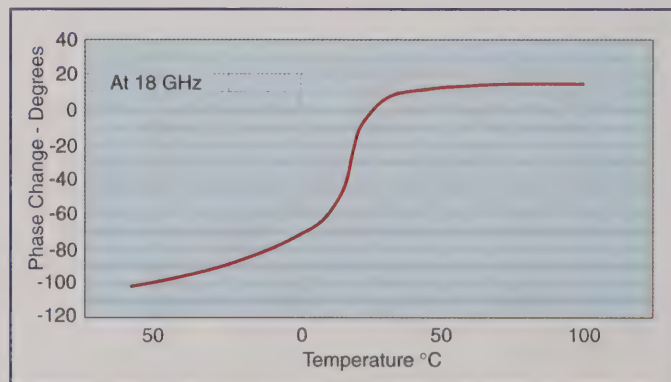
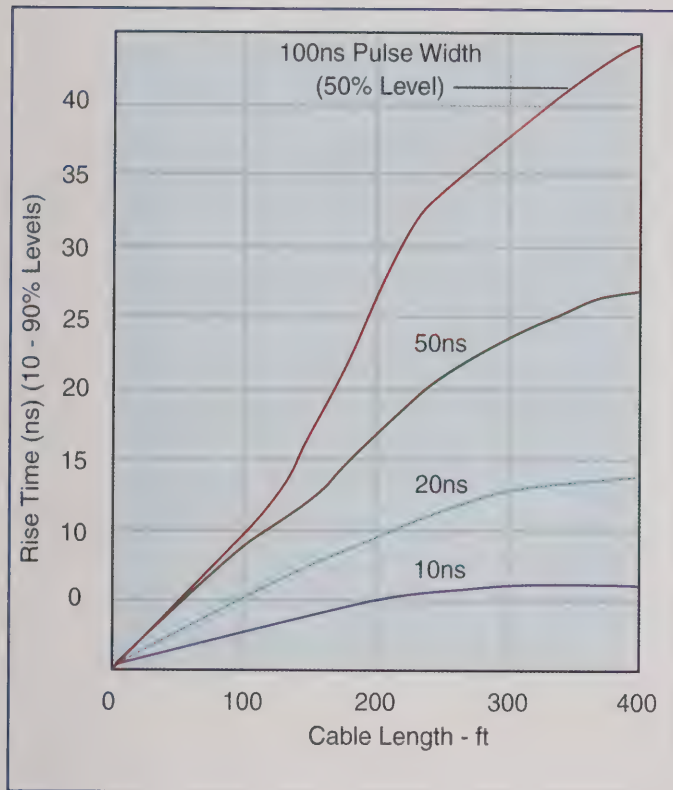


Fig. 11
Pulse Distortion



Delay lines made from coaxial cable can sometimes benefit from using lower velocity cables, thus providing maximum delay in the shortest length. But, the difference in loss between the lower and higher velocity cables must also be taken into account.

I. ELECTRICAL LENGTH STABILITY

Applications such as antenna feed systems may require many cable assemblies that are trimmed to a specific electrical length. In these applications, the change of the electrical length of the cable with temperature, flexure, tension and other environmental factors is critical. The variation of electrical length with temperature for standard flexible cables is shown in Figure 10.

For polyethylene insulated cables: -100 to -250 parts per million/ $^{\circ}$ C.

For TFE insulated cables: -50 to -100 parts/million/ $^{\circ}$ C.

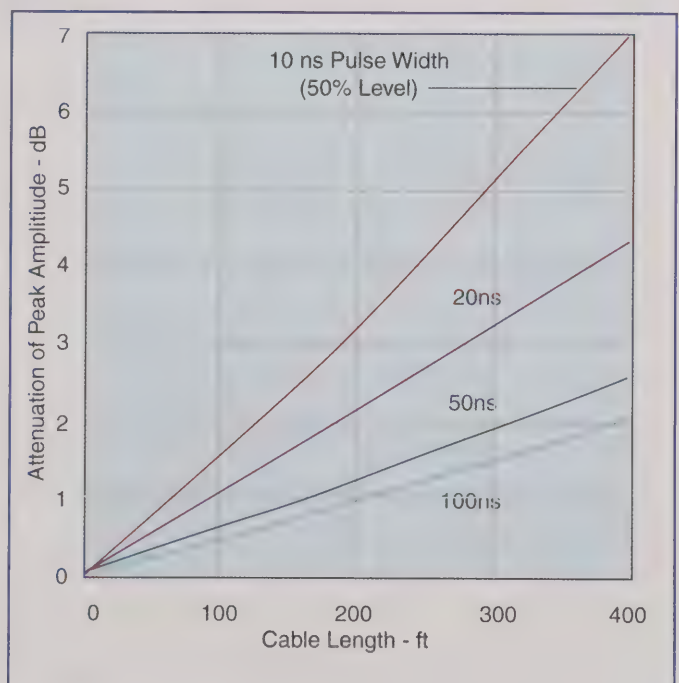
The variation of electrical length with temperature for the standard foam dielectric semiflexible cables is -20 to -30 parts/million/ $^{\circ}$ C.

Times has special flexible and semiflexible cable designs with improved electrical length versus temperature characteristics. Semiflexible cables having an electrical length change with temperature as low as five parts/million per degree centigrade are available. See SFT and Coppersol Low Loss CLL cables.

J. CUT-OFF FREQUENCY

The cut-off frequency of a coaxial cable is that frequency at which modes of energy transmission other than the Transverse Electro-Magnetic (TEM) mode can be generated. It does not mean that the TEM mode becomes highly attenuated. This frequency is a function of the mean diameter of the conductors and the velocity of propagation of the cable. The higher modes are only generated at impedance discontinuities and in many situations the cable can be operated above the cut-off frequency without substantial VSWR or insertion loss increase. However, it is recommended that cables not be operated above their cut-off frequency.

Fig. 12
Pulse Amplitude vs. Length



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K. PULSE RESPONSE OF COAXIAL CABLES

1. The following characteristics must be considered when analyzing the Time Domain response of cable to pulses or step functions:

- a: Impedance and Reflection;
- b: Rise Time;
- c: Amplitude;
- d: Overshoot or Preshoot;
- e: Pulse Echoes.

a: Impedance and Reflection

1. Select impedance to match system requirements.
2. The impedance will vary along the length of cable. Variations of +5% are not uncommon. Cables can be produced to tolerances of 2%. Tighter tolerances are not recommended.

b: & c: Rise Time and Amplitude

1. The output rise time is a function of input rise time, pulse width and cable attenuation. A typical pulse response is shown in Figures 11 and 12, while a typical step response is shown in Figure 13. Increased cable temperature causes an increase in rise time and decrease in amplitude.

d: Overshoot or Preshoot

1. Figure 13 shows the overshoot which can be encountered with a 0.1 ns input pulse rise time in cables due to finite reflections. Such overshoot is not common in cables with longitudinally extruded dielectrics.
2. Preshoot is encountered in some balanced delay lines and can be minimized by cable design.

e: Pulse Echoes

When a narrow pulse is placed on a cable, the distortions noted above will occur. In addition, a small pulse of energy may emerge after the initial pulse has arrived. This pulse echo is caused by finite periodic reflections within the cable. Normally the echo level can be neglected.

L. SELF-GENERATED CABLE NOISE

A noted cable phenomenon, is the generation of acoustical and electrical noise when flexed. The acoustical noise is a function of mechanical motion within the cable. Such noise (and the associated mechanical and frictional force) is minimized by proper cable design. Electrical noise generation is attributed to an electrostatic ef-

fect, which in testing has exhibited more than 500 millivolts in RG cable. This noise voltage can be minimized by preventing motion between dielectrics and conductors or dissipating electrostatic charges between conductors and dielectrics with semiconducting layers. Low noise constructions must take into account the life expectancy and environmental conditions to which they are subjected. Times manufactures low noise cables for special applications.

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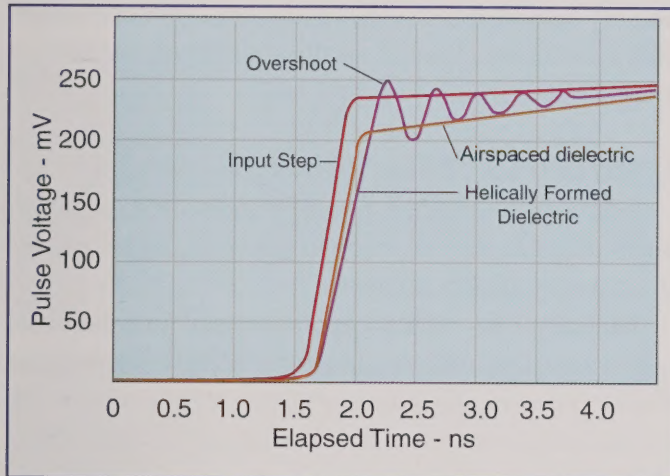
M. OPERATING TEMPERATURE RANGE

1. The operating temperature range of flexible coaxial cable is determined primarily by the operating temperature range of the dielectric and jacketing materials. Note that only silver plated conductors are suitable for long term use at temperatures over 80 degrees C.

2. Operating temperature limits of the most commonly used dielectrics and jacket types are given in the following table:

MATERIAL	Temperature Range
Polytetrafluoroethylene (PTFE)	-75°C to + 250°C
Polyethylene	-65°C to + 80°C
Foamed Polyethylene	- 65°C to + 80°C
Foamed or Solid Ethylene Propylene Jackets	- 40°C to + 105°C

Fig. 13
Step Response
(Output Amplitude vs. Time)



Fluorinated Ethylene Propylene (FEP)	-70°C to +200°C
Polyvinylchloride (PVC)	- 50°C to + 85°C
Ethylene Chloro Trifluoroethylene (ECTFE)	- 65°C to + 150°C
Polyurethane	-100°C to + 125°C
Perfluoroalkoxy (PFA)	-65°C to + 260°C
Nylon	-60°C to + 120°C
Ethylene Propylene High Molecular Weight Polyethylene	- 40°C to + 105°C
Crosslinked Polyolefin	- 55°C to + 85°C
Silicone Rubber	- 40°C to + 85°C
Silicone Impregnated Fiberglass	-70° to + 200°C
High Temperature Nylon	- 70°C to + 250°C
Fiber	- 100°C to + 250°C

N. FLEXIBILITY

Coaxial cables with stranded center conductor and braided outer conductors are intended for use in those applications where the cable must flex repeatedly while in service. Cables with stranded center conductors will exhibit higher attenuation compared to cables with solid center conductors. In general, the higher the number of strands, the better the flexibility and the greater the increase in attenuation.

Standard braided outer conductor constructions will withstand over 1000 flexes through 180° if bent over a radius 20 times the diameter of the cable. Flexible cables may be stored, and are normally shipped, on reels with a hub radius greater than 10 times the diameter of the cable. If a flexible cable is to be installed in a fixed, bent configuration, the minimum bend radius recommended is 5 times the cable diameter. Tighter bends can be made. Special braid designs are available for improved flex-life.

Coaxial cables with a tubular aluminum or copper outer conductors, commonly referred to as semi-flexible or semi-rigid cables, will not withstand more than ten 180-bends over a bend radius equal to 20 times the diameter of the cable. Semi-flex cables are normally shipped on reels having a hub radius of 20 times the O.D. of the cable. Semi-flex cables may be field bent for installation. The minimum recommended bend radius is equal to 10 times the O.D. of the cable. Cables bent on a bend radius of 5 times the O.D. of the cable may exhibit mechanical and electrical degradation.

O. ENVIRONMENTAL RESISTANCE

The life of a coaxial cable depends on many factors. The effects of ultra-violet exposure, high humidity, galvanic action, salt-water and corrosive vapors on the materials used are prime causes of cable failure. Resistance to flame must also be considered. The following guidelines apply:

a. Sunlight: For low temperature cables exposed to sunlight (ultra-violet), the use of high molecular weight polyethylene, with a specific carbon black particle size, % by weight and particle distribution, is recommended for maximum life expectancy. Polyvinylchloride jackets exhibit a life expectancy of less than 1/2 that of properly compounded polyethylene.

b. Humidity or water vapor can enter flexible cables through pin-holes in the jacket, at the connector, or by vapor transmission through the jacket. All materials exhibit a finite vapor transmission rate. For example, a ten foot length of cable with a polymer outer jacket exhibits a helium leak rate of approximately 10^{-4} cc/sec/ft. Even the least porous thermoplastics, such as FEP, do not offer a significant improvement. In airborne applications,

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the combination of finite vapor transmission rates and large temperature extremes cause condensation in cables. The moisture can collect in low areas causing corrosion or shorting of a connector. One method of preventing moisture accumulation in cables is to fill all voids with a moisture-proofing compound which will not harden with age. See LMR-DB and Imperveon Cables for additional data. Times also supplies hermetically sealed cable assemblies with leak rates of less than 10^{-5} cc/sec/ft.

c. Salt-water Immersion-The electrical characteristics of cable will be rapidly affected if the conductors are exposed to salt-water. Unless an immersion test is performed on the jacket, there is a good possibility of one pinhole per 1000 feet. Even if sufficient tests could be performed, damage during installation or damage from rodents normally will cause leakage. Pressure-tight, non-hosing cables capable of withstanding the pressure at the required cable depth can be recommended.

d. Corrosive Vapors: The use of tin and silver coatings does afford some protection against corrosive vapors. However, such protection is short-lived. For installation near salt-water or chemical plants, a filled cable such as LMR-DB or Imperveon is recommended.

e. Underground Burial & Galvanic Action: Underground moisture which comes in contact with any cable metals, will cause rapid corrosion. Tubular aluminum outer conductors have been almost destroyed in 90 days. Therefore, any cables installed underground should have pinhole-free jackets. Since jacket damage due to installation techniques and rodents can occur, cables filled with a flooding compound should be used. For maximum reliability against rodents, a steel tape armor with over-jacketing is recommended.

f. Flame Resistance: Cables have different degrees of flame re break strength of the outer conductor, if the center conductor will stretch up to 10% before breakage. Caution must be taken with cables with copper-covered steel or alloy center conductors where breakage would occur with only 1 to 10% elongation. Conductor sizes less than 26 AWG can easily be broken during as-

sembly operations. Special alloy conductors are available which can achieve a tensile strength of 110,000 psi and 10% elongation.

Q. QUALIFICATION APPROVAL

Often, cables must be qualified to certain standards to allow usage in particular applications. Typical examples of necessary qualifications are:

Military: Most military applications require that cable conform to particular specifications. Many of these specifications require the manufacturer to qualify product by conducting a series of tests on a length of cable with a military representative present as a witness. MIL-C-17, the basic specification for most coaxial cables, requires a Qualified Products List (QPL). TMS maintains numerous MIL-C-17 qualifications.

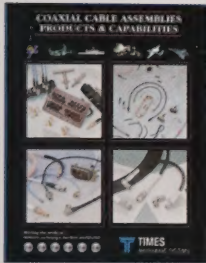
Commercial (UL) Approval: The building codes of many cities require that cables installed in their buildings be approved by the Underwriters Laboratories (UL). With UL service, the cable is subjected to a clearly defined series of tests and examinations, and has met the quality and safety standards imposed by Underwriters Laboratories. Approval of new designs meeting UL standards normally can be made in a relatively short period of time. A large variety of TMS products are UL approved.

New York State Requirements: Article 15, Part 1120 of the New York State Uniform Fire Prevention and Building Code requires that materials used in some buildings and transit systems be tested and registered with The New York Department of State. For the TMS products tested, the fire/gas/toxicity data is found in: DOS file number 16120-931203-4001.

London Underground Limited: TMS has gained LUL approval on a series of low-smoke cable constructions. These cables were tested for smoke emission, toxic fume emission, and flammability assessment against the requirements of the London Underground Code of Practice for fire safety.

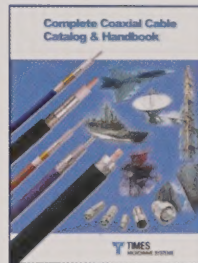
Contact your TMS representative for more information regarding TMS product qualifications.

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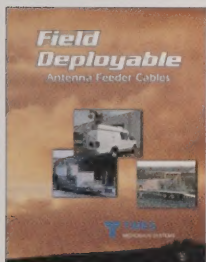
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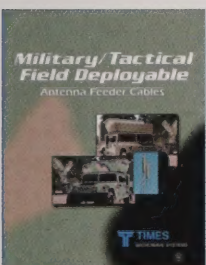
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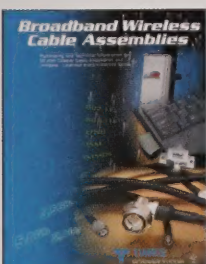
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TIMES MICROWAVE SYSTEMS is dedicated to *total* customer satisfaction and superior results for our shareholders in all we do.



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